JOINT DISCUSSIONS

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1. NEW DEVELOPMENTS IN DOCUMENTATION AND DATA SERVICES FOR ASTRONOMERS

Scientific Organising Committee

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NEW DEVELOPMENTS IN DOCUMENTATION AND DATA SERVICES FOR ASTRONOMERS

Report on the proceedings of Joint Discussion 1 at the 20th General Assembly of the International Astronomical Union at Baltimore, Maryland, U.S.A., on 1988 August 3

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ABSTRACT. The meeting provided a forum in which those responsible for documentation and data services in astronomy could interact with users of these services in an endeavour to establish how new techniques for the distribution and retrieval of information may be used to best advantage by astronomers. The report contains summaries of each of the short papers that were presented during the four sessions and brief accounts of the ensuing discussions. The principal topics were: the preparation and publication of papers and reports; bibliographic data services; electronic-mail facilities; archiving of current observational data; the changing role of libraries; and the maintenance of the historical record of astronomical activities.

1. INTRODUCTION

1.1 Background to the Joint Discussion

During the short period of less than three years since the 19th General Assembly of the International Astronomical Union (IAU) in Delhi, India, there have been two areas of rapid advance that have had major impacts on documentation and data-service activities in astronomy. Many authors now use "desk-top publishing" techniques to produce camera-ready copy that is comparable in appearance with the output of commercial photo-typesetting equipment, while 'electronic mail' is now widely used for rapid, cheap communication within and between many, but not all, countries of the world. Other areas of growth in recent years include the distribution of preprints rather than of reprints of papers, and information retrieval by remote interrogation of large bibliographic data-bases. The direct recording in digital form of observational data has also become much more common and is leading to the need for new procedures for the archiving of data; at the same time astronomers are becoming more aware of the need for greater attention to the conservation of astronomical plates and documents. It was therefore very appropriate that these and other related matters should be discussed at the 20th General Assembly of the IAU in 1988 at a meeting that brought together astronomers from many different commissions with librarians and other providers of the information services that are used by astronomers.

D. McNally (ed.), Highlights of Astronomy, Vol. 8, 69–96.

The busy schedule of the IAU General Assembly meant that only one day (Wednesday, August 3) could be allocated to such a meeting, and so it was preceded by IAU Colloquium No. 110 on "Library and Information Services in Astronomy". This was held in Washington, D.C., on July 29-30 and at the Goddard Space Flight Center on August 1. (The original intention had been to hold a workshop at the U.S. Naval Observatory, but the numbers wishing to attend soon proved to be so large that it was decided to hold it at the nearby Dupont Plaza Hotel and it was necessary to arrange a more formal programme than had been originally envisaged.) The programme of Colloquium 110 covered a wider range of topics than that of Joint Discussion 1; in particular, more attention was given to the problems of librarians and astronomers in countries that do not have access to the advanced computer and communication systems that are now available in highly-developed countries. Financial support was provided by the IAU and by other American organisations and individual librarians, and so several librarians and others from less developed countries were able to attend the Colloquium and, in some cases, the General Assembly as well. Participants in the Colloquium who were not able to attend all of the General Assembly were invited to attend the Joint Discussion in order that they could interact with astronomers who had not attended the Colloquium; about 20 such persons took part in the Joint Discussion, some of them as speakers.

The Joint Discussion thus served as the valuable follow-up to Colloquium 110 and it also provided an introduction to more detailed discussions during the subsequent meetings of IAU Commission 5 on Documentation and Astronomical Data. It also created a greater awareness amongst astronomers of the functions of Commission 5, and it stimulated some to attend its meetings which were necessarily held simultaneously with other scientific meetings on specialists topics.

The following report on the Joint Discussion contains summaries of the four sessions, each of 1½ hours, which consisted of a series of short prepared contributions and periods for general discussion. Comments made during the period of general discussion have usually been reported immediately after the contribution to which they referred; editorial insertions of additional comments or information have been indicated by [enclosure]. In several cases the speakers have submitted papers on their topics for publication in the Proceedings of Colloquium 110 (Wilkins and Stevens-Rayburn 1989), which contains other papers and reports of discussions on these and related topics. The subsequent meetings of Commission 5 are reported in Volume 20B of the Transactions of the IAU, where will also be found the text of a resolution on the improvement of publications that was adopted by the General Assembly during its final session on August 11.

1.2 Introduction to the Joint Discussion

The chairman of the first session, Professor Patrick Wayman, a former General Secretary of the IAU, welcomed the participants to the Joint Discussion, who numbered about 200.

The chairman of the Scientific Organising Committee, George Wilkins, then summarised the principal aim of the Joint Discussion as the transfer of information and ideas between the providers and the users of documentation and data services in astronomy. It would act as a follow-up to IAU Colloquium 110 and as an introduction to the meetings of Commission 5 on the following days. There would be four sessions:

Session 1 on developments in primary publishing would be concerned with economic issues and with new techniques that would affect the long-term character of the astronomical literature and of the author's role in the publication process. Consideration would also be given to the revision of the IAU Style Manual which, it is hoped, will be of assistance in the preparation of astronomical papers for journals, as well as of reports and papers of IAU publications.

Session 2 on developments in the retrieval and distribution of information will provide information about the availability and use of bibliographic databases that cover fields of interest to astronomers and also about the use of computer networks to provide rapid communication between individuals and to 'publish' urgent announcements and other such information. The project to develop a thesaurus of astronomical terms to improve the quality of information retrieval would also be described and discussed.

Session 3 on developments in data archiving and retrieval would include a review of data-centre activities, but would be primarily concerned with new systems for the archiving of new observational data. The problem of the designation of the sources to which the data referred would also be discussed.

Session 4 on the changing role of astronomical libraries would provide a review of the discussions at IAU Colloquium 110 on the current problems of astronomical libraries and on the ways in which they are developing new techniques and activities in response to the availability of new facilities. Finally, there would be consideration of the task of maintaining the historical record through the archiving of correspondence, manuals and other unpublished records, plates, tapes and discs; this would include guidance on the selection, indexing and conservation of such records.

Participants who gave prepared contributions and others who spoke during the discussions were invited to submit short papers or notes for use in the compilation of the proceedings.

2 DEVELOPMENTS IN PRIMARY PUBLISHING

2.1 The publisher's viewpoint

2.11 S. Mitton: Economic issues in astronomical publishing. Simon Mitton, of the Cambridge University Press (CUP), indicated that he would be concerned mainly with the factors that affect the prices of astronomical books; many of them apply also to journals. He would base his statistics on the experience of CUP, but he felt that they would be typical of other major publishing houses that aimed to cater for astronomy.

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There was a steady decline in the size of the core market from 1965 until about 1981, and this appears to have been largely due to physics libraries being unable to afford to take books in peripheral areas; another factor is that research grants are often now insufficient to allow for the purchase of extra books. There are now about 550 university libraries and astronomical organisations that buy astronomy books on a regular basis. The number of copies bought by individuals from their own pockets may run from only 100 up to several thousand in the case of very popular books. The availability of photocopiers may have reduced the number of copies bought by individuals, but on the other hand publishers should not complain of photocopying if they have set the prices on the basis that libraries will be the only purchasers of a particular book. The contributions towards the sale price of a book are typically as follows:

Physical manufacture (typesetting, printing and binding)	25%
Fees/royalties	10%
Bookseller discount	35%
Marketing, distribution, advertising and overheads	25%
Surplus/profit	5%

These proportions vary from book to book and sometimes the bookseller discount is higher than 35% especially for books that are imported. Some publishers may look for a higher surplus than 5%, possibly to 15%. Those who consider that book prices are too high because of profits made by the publisher should invest in their shares! (The Cambridge University Press is a not-for-profit organisation.) The typical price for a 400-page book will depend primarily on the number of copies that the publisher expects to sell and may be illustrated as follows:

Specialised monograph (typeset)	approximately 1000 copies	$75-120
Conference proceedings (camera-ready copy)	400-1000 copies	$50-80
Graduate textbook	2500 copies over 3 years	$35-45
Undergraduate textbook	5000 copies over 3 years	up to about $25
Popular books	10^4-10^5	$35 maximum

The popular or mass-market books are bought mainly by amateur or armchair astronomers, and it can be said that they, to some extent, subsidise the professional market. The price of a book may be affected by various factors; for example, although authors of papers in conference proceedings do not receive royalties, the publisher may make a contribution to the cost of the organisation of the conference and these expenses are recovered from the sales of the proceedings. Inclusion of colour plates may increase significantly the cost of production. Advertising may be used sometimes to reduce the prices of conference proceedings, for example. It is not expected, however, that the use of new technologies, such as desk-top publishing, will reduce the prices significantly. The costs of composition have already been

significantly reduced over the past 10 years by the introduction of new technology and by the elimination of restrictive practices. The effect of desk-top publishing techniques will be mainly to increase the quality of the product; competition between publishers helps to keep down the prices and the editorial boards of journals can help to control costs, but it should be noticed that societies, such as the Royal Astronomical Society, do want to generate a surplus from the sales of their publications in order that they may build up cash reserves against future periods when they may wish to sell the journal at a loss. It may be noticed that this is shown in the published accounts of the Royal Astronomical Society.

In the future, one can see an increased use of desk-top publishing, but this will require that standards be introduced for disc size and formats and so on; the variety of typefaces used should also be limited. Electronic mail will also be increasingly used for the submission of papers and in order to speed up the refereeing processes. It is still expected that copyediting will necessary in order to remove at least the worst of the inconsistencies that are so common in camera-ready copy today.

2.12 Discussion. The first questioner asked why authors should get less than 10% in royalties while the booksellers margin was 35% or more, and he then went on to ask whether booksellers are really necessary when most of the sales are to libraries. In response Mitton said that it would be impossible to increase the royalties without putting up prices sharply; attempts had been made to cut out booksellers by the use of direct mail-order, but it was found that many librarians prefer to go through an agent or bookseller in order to save their own time; an agent will deal with many different publishers and yet present the librarian with only one invoice; this could result in a saving of staff required in the library. A. Ratnakar pointed out that this would be less important in developing countries; he had often tried and failed to place direct orders with the publisher. Mitton commented that there are difficulties in importing books into India because of the bureaucracy; if books are sent directly through the mail then this also leads to problems of customs and losses.

2.2 New techniques for the submission and preparation of papers.

2.21 H. Abt: The use of new techniques in editorial procedures. Helmut Abt, the editor of the Astrophysical Journal, considered the effects on the publication of journals of the introduction of new techniques in each of the chronological steps in reviewing and publication.

(a) Submission. For speed and reliability, express mail is the best current method. With regular mail we have lost manuscripts mailed between American cities, and about 0.1% of the manuscripts from abroad are lost in transit. Even airmail can take up to one month between the USSR and USA. Facsimile transmission has marginal quality at present and is not yet suitable for long manuscripts, although the quality is adequate for review copies.

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Computer-readable diskettes are not yet competitive because (1) they still require much work by the publishers, (2) they require much more work by the authors, (3) there are still too many competing software systems, and (4) papers are written too infrequently (about one paper worldwide per author per year) for authors to remember the system details, although that is not true of manuscript secretaries.

An excellent current method is the use of an optical character-recognition machine made by Kurzweil, which scans and reads typescripts in any typeface. An operator follows the interpretation for about two pages to monitor for confusing letters (e.g., one and lowercase L); then the machine scans one page per minute and records it in a computer-readable file. This method requires the least work and consistency of the authors. The operator edits this file for composition by a phototypesetter. The American Institute of Physics uses it for 40% of its manuscripts, namely the non-mathematical ones.

(b) Reviewing. In the future, manuscripts will be sent to referees by electronic mail (e-mail), saving about a week due to mailing. At present about 10% of the referee reports are sent by electronic mail, and the fraction is increasing rapidly.

(c) Transmission to publishers. At present this is done by express mail for the reason of reliability.

(d) Copyediting is still necessary because many authors do not recognise the need for consistency. Currently copyedited manuscripts are discussed with authors by telephone for the Ap.J. Letters and are mailed to the main journal authors. In coming years the latter should be done by telefax or e-mail.

(e) Publication. To save shelf space, future publication may be on both paper and compact disks (CD), with the latter used for older issues. CD publication will not be much cheaper because only the costs for paper and mailing are reduced. The eventual method will probably be to have individual accepted papers entered, when ready, into a central memory bank for immediate access by readers. Printed issues of journals may then no longer be produced

2.32 G. A. Wilkins: Author's viewpoint of new techniques. Wilkins expressed the view that the use of desk-top publishing techniques for the preparation of camera-ready copy for papers for conference proceedings is producing results of high quality but, on the other hand, such techniques make much more demands on the author: for example, he needs to have much more awareness of typographical matters, of the detail associated with copyediting, and of various systems of computer software. The extra effort may well be justified if the proceedings are published more quickly, but the author will be frustrated if it is necessary for him to revise his paper extensively before publication in order to meet the standards normally expected in journal publications. Many authors will be reluctant to spend all the time and effort that is required to learn and use these new techniques, and moreover it seems unlikely that they are likely to result in significantly lower prices for journals. The question therefore arises as to whether greater use of these techniques should be demanded.

2.33 G. A. Wilkins: IAU Style Manual. Wilkins then went on to draw attention to the new IAU Style Manual that he is preparing and that is to be published in the Transactions of the IAU with the reports on the meetings at Baltimore. The Manual is intended to provide a general guide on the writing of astronomical papers and reports, and on copy preparation for authors, editors, referees and even publishers. The Manual is much more detailed than previous versions of the IAU Style Book since it covers many points that would normally be dealt with by the copyeditor of a journal. Particular attention is, however, paid to such matters as units and designations of astronomical objects that are primarily the responsibility of the author; it also contains other information that it is hoped will be useful to readers as well as to authors. The drafts have been circulated quite widely, and several of the editors of the principal journals have commented on it. It is hoped that most of the recommendations will apply to all the principal astronomical journals and not just to IAU publications. One principal point of disagreement concerned the form of references; in particular, Wilkins considered that references should include the title of the paper and should give the full internationally-agreed abbreviations for the titles of journals: however, several of the editors considered that this would take up too much space and that titles should be omitted and very abbreviated forms should be used for the principal journals. These matters were discussed further at a later session of Commission 5 on editorial policy.

2.34 Discussion. David Lide, the president of CODATA, shared the concern about whether authors should be expected to act as copyeditors and compositors. The computerised typesetting of tables in large central facilities was very valuable, but it was clear that the standards of presentation have gone down very rapidly. Most authors are unwilling to learn all the nuances of style and to take into account all the standards necessary to achieve a fully satisfactory result. He noted that the publisher's copyeditor now works at a terminal and no longer uses blue pencil on a manuscript. On the other hand, Bob Hanisch thought that authors were not reluctant to learn detail, but that the main problem is the lack of standards; it would be possible to prepare standard templates in computer software to match the style of the journals. H.-U. Daniel, who is responsible for Astronomy and Astrophysics in Springer-Verlag, stated that his company had developed a package that prompts the author about layout and other details; he did, however, recognise that some decline in quality is to be expected. The instructions that secretaries need to follow cover about 5 pages. Astronomy and Astrophysics is willing to accept manuscripts that have been produced by TEX; the situation will be improved when MATHOR is available since the display on the screen corresponds to what will be printed. He accepted, however, that savings in the cost of typesetting by the use of such techniques will not be large; in any case the costs of printing and binding make up a large proportion of production costs. Alan Batten considered that the biggest barrier to a scientist acting as copyeditor is his or her own attitude: many do not consider that the things that copyeditors attend to are important; even those of us who do are not very good at copyediting; the new ways of book production force the author to be his own copyeditor and we need more than ever to regard editors and publishers as our partners and not as our adversaries. Abt in reply to

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Hanisch considered that, in fact, good progress had been made in the development of common formats for journals. Barry Lasker said that it is important to distinguish between formal publication and informal communication, such as is now provided by computerised bulletin boards, and he was concerned that this distinction might be blurred if papers were submitted to a central database and not published in printed form. Several participants spoke in favour of the inclusion of the full title of papers in the list of references, and it was pointed out that very long titles could easily be abbreviated by the use of leaders ... . In order to try to obtain a better indication of the general feeling of the meeting on this matter, the chairman asked for a show of hands of those who were in favour of the inclusion of titles, and those who did not feel that they were sufficiently useful to justify the extra space; about 50 of those present expressed a preference for titles, while 30 did not want them.

2.4 Publication of data in printed form

The chairman stated that Professor Jaschek of the Data Centre at Strasbourg had intended to be present but had been unable to attend at the last moment. He had, however, supplied a summary of the remarks that he intended to make; the chairman then read the following short paper:

2.41 C. O. Jaschek: Journal policies and alternative procedures for the publication of data. The principal reasons why we publish on paper are that (a) paper is cheap, (b) paper provides a long lasting support, and (c) paper provides an immobile version (i.e. unchangeable) of the author's script. In general we find that there are no problems with small collections of data, e.g. 500 observed colours or 300 proper motions, but problems do occur with larger data sets. Page charges make compression necessary, and this may produce almost illegible results in microprint or suppression of important information, such as dates of photometric observations.

There also exist routine observations, like double-star measurements or minor-planet positions, which are sometimes not accepted by journals because they only contribute to later work and cannot be used for immediate interpretation. Besides this, we have the compilation catalogues - such as Mermilliod's photoelectric catalogues of some ten thousand stars - which journals simply refuse to publish. Such catalogues are only available on magnetic tape, and what appears in print is, at most, an announcement. Finally, the problem becomes essentially unsolvable with huge amounts of data like those coming from instruments in space or from radiotelescopes. Often these are published as 'observatory publications', but this decreases their availability.

As a result, valuable data are lost from general circulation; various remedies have been proposed.

(a) Microfiche. This is a cheap and durable support, lasting at least 40 years. Microfiche were never popular with astronomers because they need a reading device. For long compilation catalogues they are nevertheless the best solution. For shorter data lists - say less than 6000 lines - they are cumbersome.

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(b) Unpublished data archives. The IAU Commission 27 on Variable Stars keeps such an archive on machine-printed pages. The problem here is that most people do not know of the existence of these archives, nor about their contents. As a consequence the archives are very sparsely used.

(c) Data journals. Data journals exist in other sciences, as in physics and chemistry, where the data flow is larger than in astronomy; they include only data and some technical details. Since Jaschek was convinced that such a journal would be successful he attempted to sell the idea, and he even found a publisher. Unfortunately, astronomers (usually the happy variety of colleagues who do not try to publish long data series) were against it, firstly because it would mean one more journal to buy, and secondly because if the data were not properly discussed, one could perhaps get some data of lower quality published. So in the end he gave up.

An intermediate solution would be to set a limit to the number of publishable data and convince authors that they should agree to have their observations printed on microfiche and provide their observations for data centres on tape or diskette. If observations are kept only on microfiche or only on tape, we have difficulties of access in the first case and no permanent record left in the second. Please observe that magnetic tape is perishable - five years or so - and that the often recommended remedy, namely a digital optical disc, has no guaranteed lifetime. Only one manufacturer, to his knowledge, has indicated a lifetime of 20-30 years.

In summary, this means that we will have to continue with printed journals for short collections of data, but that we must put the larger data collections into data centres. Indeed data centres were set up just for that purpose.

2.42 Discussion. There was no time for discussion of Jaschek's contribution.

3. DEVELOPMENTS IN INFORMATION RETRIEVAL AND DISTRIBUTION

The chairman of Session 2 was Professor Hauck of the University of Lausanne, Switzerland.

3.1 Retrieval of Bibliographic Information.

3.11 J. Rey-Watson: Bibliographic databases. Joyce Rey-Watson, librarian at the Center for Astrophysics (Cambridge, Mass., USA), first of all pointed out that until recently on-line retrieval of bibliographic information about astronomical topics has been largely limited to the use of databases intended primarily for physics, and information about particular objects could only be obtained if the name of the object was included in the title or abstract of the paper. This situation has been dramatically changed by the development of SIMBAD (Sets of Identifications, Measurements and Bibliography for Astronomical Data) by the Data Centre of the Observatory of Strasbourg (CDS). The database is held on a computer in Paris but is accessible from the USA on a transatlantic link provided by NASA; a terminal for

demonstration was available in the exhibition associated with the General Assembly. Searches are automatically carried out for all known names of each object, even though the enquirer need specify only one name.

The second development of particular importance to astronomers is the agreement between the Astronomisches Rechen Institut (ARI) at Heidelberg and the Fachinformationszentrum (FIZ) at Karlsruhe to the effect that Astronomy and Astrophysics Abstracts will be available on-line in the Physics Briefs database from the beginning of 1989.

Other major databases that are accessible to astronomers for on-line searches include:

INSPEC: This is based on Science Abstracts A (Physics) and goes back to 1969;

NASA/RECON: An aerospace database developed by NASA that is available through NASA and ESA-IRS: it dates back to 1962;

SCISEARCH: This is based on the Science Citation Index and is used in a different way to trace the development of a particular topic from earlier references to the present day.

Other aids in bibliographic searching include:

Current Contents: this appears weekly and contains the tables of contents of many astronomical journals.

Dissertation Abstracts Online: this includes all American theses back to 1961.

Astronomy and Astrophysics Monthly Index: published in California in both printed and machine readable form.

Lunar and Planetary Bibliography: this is available on-line at the Lunar and Planetary Institute (Houston, Texas); it covers the Moon, planets, asteroids, comets, meteorites, and space colonisation and utilisation.

Finally, Rey-Watson indicated that she would be glad to provide additional information on request.

3.12 Discussion. N. G. Roman enquired whether cross-referencing by position is possible in SIMBAD. Rey-Watson stated that the enquirer was able to specify limits between which the coordinates of objects of interest should lie.

3.2 Electronic bulletin boards and similar services

3.21 B. M. Lasker, P. M. B. Shames and L. Butler: Public access computer services. Barry Lasker, of the Space Telescope Science Institute, considered that public access computing services, based on the existing and rapidly developing networks that interconnect astronomical institutions, already offer the community significant resources for information exchange; and the potential for growth at minimal cost is limited only by the imagination and enthusiasm of the scientific users. The requirements for such services are (1)

widespread connectivity for both direct logins and for mail handling, (2) friendliness to users regardless of their level of sophistication with computers, (3) active, responsible management of the scientific materials, and (4) effective management of the computer resources. Some networks, such as BITNET, provide e-mail facilities, but not login access facilities. It has been found that most users read but do not contribute to the bulletin boards, and that astronomers are usually very different from the software community and demand a high level of service. The service should be available at all times and the bulletin board should be controlled. Remote interactive working can be very expensive unless the system is efficient and is used effectively.

One example of this kind of service is the Astronomy Information System (ASTIS), which has been established at the Space Telescope Science Institute in order to provide open access to bulletin boards, databases, information, and a directory of astronomers. Access to the ASTIS services is supported on SPAN, the ARPA Internet, and the international packet-switching (PSS) networks so as to be within reach of the widest possible community.

The initial implementation contains material on SN 1987A, the Space Telescope Science Data Analysis System, and directory entries for over 700 individuals and astronomy sites (as collected from individual contributions and from the activities of the RGO and the AAS). A project to expand the service to include Space Telescope news, proposal information, and bulletin boards on other astrophysical topics is in progress.

3.22 Discussion. P. W. Hill stressed that users must be careful not to waste time and money when working interactively over PSS networks. P. Wehinger considered that bulletin boards need contributions from users.

3.23 B. G. Marsden: The Computer Service of the IAU Central Telegram Bureau and Minor Planet Center. Brian Marsden, of the Harvard-Smithsonian Center for Astrophysics, described the development and current status of the computer services now provided by the IAU Central Telegram Bureau and by the Minor Planet Center, of which he is the Director. The impetus for providing a mechanism for computer distribution of the IAU Circulars was Comet IRAS-Araki-Alcock. Announced just one week before its passage only 0.03 au from the Earth in May 1983, this comet was extensively discussed in airmailed Circulars that failed to reach the majority of recipients until after it had passed! By January 1984 appropriate arrangements had been made on one of the VAX computers at the Harvard-Smithsonian Center for Astrophysics, and during that first year of operation of the Computer Service there were some two dozen subscribers, all but two of them located in North America.

Initially, use of the Computer Service required the subscriber to contact the VAX by modem. In addition to providing the IAU Circulars, the system had a facility for the exchange of messages. There was also a useful feature that allowed the caller to extract orbital elements of comets and minor planets from the Minor Planet Center's files and to calculate eleven points in an ephemeris - at an interval between 0.1 day and 20 days.

XMODEM and KERMIT file-transfer protocols were available, and late in 1985 the system was transferred to a MicroVAX computer essentially dedicated to the work of the Central Telegram Bureau and Minor Planet Center. E-mail capability become possible by BITNET, but because of its frequent unreliability, it was decided to continue to provide the electronic IAU Circulars only to those who actually logged in for them. A new addition to the Computer Service allowed the caller to find all the known comets and minor planets within a 5-degree range of right ascension at a particular time. Submitted as a batch-job running while the caller made use of other features, this calculation enables him to establish whether a suspected comet discovery was new or whether a possible nova might be a particular minor planet.

By the beginning of 1987 the Computer Service boasted a steady 40 or so subscribers, but it was still the case that 90% of them were in North America. With the discovery of the LMC supernova there was a dramatic change. The possibility of connecting with SPAN suddenly became a reality. Modems were relegated to amateur use as professional callers could "set host" from other VAX computers. The number of subscribers tripled over the course of a single month, and a second MicroVAX was added in the expectation that one or the other computer would be available at all times. A separate login allowed the SPAN user to e-mail the IAU Circulars to a specific VAX node and username.

Automatic e-mail distribution of the IAU Circulars to subscribers who can conveniently be reached via SPAN or BITNET was finally organized in July 1988. About half of the Computer Service users seem to be in this category. It still happens that messages get lost (or, at least, substantially delayed), but subscribers are able to log in and read any that they have not received.

Although some may think this to be an unnecessary relic from the days of the absolute dominance of the printed word, the Computer Service still always circulates complete IAU Circulars, rather than individual items as they become available,. With only some 20% of the subscribers participating in the computer dissemination, and all of these restricted to the nations of the first world, there is certainly no plan to discontinue the printed Circulars, which should still be regarded as the "official" version.

It is certainly to be hoped that, by the time of the next IAU General Assembly, astronomers in many more countries will be able to participate in the Computer Service. Most of these astronomers currently rely on telex for rapid communication, and while some changes in the dissemination by telex of the most urgent data are planned, it would still be expensive to distribute complete IAU circulars in this way. New features are planned for incorporation in the Computer Service, and further suggestions are very welcome.

3.24 Discussion. Lasker wondered whether the use of the search facilities might impose a high load on the system; Marsden replied that a MicroVAX is largely dedicated to the Service and is able to meet the demands on it. A. Ratnakar commented that the Service is not available in countries like India. In reply to a question, Marsden said that

there are small fixed monthly charges for the use of the Computer Service in addition to the subscription to the mail service for the circulars.

3.3 Directories of organisations and astronomers

3.31 J.-L. Halbwachs: International directories prepared at Strasbourg. Jean-Louis Halbwachs, of the Centre de Donneés Stellaire (CDS) at Strasbourg, said he was speaking on behalf of André Heck, who had developed his first directory after finding that his publisher could not distribute publicity material properly. The International Directory of Astronomical Associations and Societies contains over 2000 entries for 65 countries; the seventh edition will be published in 1988. He later produced the International Directory of Professional Astronomical Institutions, and its first edition contains a wide range of information about 2200 organisations in 75 countries; the second edition will be published in 1989. (See references.) It is expected that new editions will be published by CDS at a frequency of two years; enquiries should be addressed to Dr. A. Heck at CDS.

3.32 Discussion. Hill wondered about the problems of obtaining up-to-date reliable data; Halbwachs replied that Heck had made every effort to check the accuracy and completeness of the data. Hauck considered that it would be useful to have the names of the astronomers of each institution, but Halbwachs felt that this would be too long. Rey-Watson felt that a frequency of 2 years is adequate for a directory. It was generally agreed that it would be very useful if the directories were to be made available on SIMBAD, since entries could be updated when new information was obtained.

3.33 C. R. Benn: World e-mail directory prepared at Herstmonceux. Chris Benn, of the Royal Greenwich Observatory, first of all spoke about the revolution in communications that had been brought about by electronic mail which is quick, cheap, convenient and informal. As a new system it still has problems, such as the complicated syntax of addresses for routing messages. Several national and international computer networks are linked together, but some parts of the world are inaccessible. He and R. Martin had felt the need for a directory and had prepared one with about 3000 entries for astronomers and 200 entries for organisations; it includes an introductory guide to the technique. Copies of the first edition have been distributed widely without charge, and the directories are on-line on the VAX computer at the RGO. He suggested that user names should have a standard form, that e-mail addresses should be given for authors of papers in journals, and that computer networks should also be used for the dissemination of news and for software exchange.

3.34 Discussion. Lasker pointed out that other countries were accessible through the PSS network, and that BITNET had links to some places not shown on the map presented by Benn; Wehinger said that a link to Moscow will be available soon. There were several comments about user names: some systems allow an alias to be used; some node managers do not allow user names to be publicised because of fear of unauthorised access by hackers; and on some systems a Postmaster is obligatory and allows messages to be sent to individuals whose user names are not known. Gösta Lyngå said that he was a keen user of

e-mail and very happy about the RGO directory for which he thanked Benn. He drew attention to the problem that arises when a node breaks down. The mail is often returned with insufficient explanation, whereas one would expect that another routing would be automatically chosen. Benn recognised the problem, but said that the response is different in different networks. The chairman closed the discussion by pointing out that such problems could be discussed further at a session of Commission 5 on e-mail on August 5.

3.4 Aids to information retrieval

3.41 R. M. Shobbrook: The IAU Thesaurus: A way to more-effective information retrieval. Robyn Shobbrook, the librarian of the Anglo-Australian Observatory, introduced her talk by giving a definition of a thesaurus: a compilation of words and phrases showing synonymous, hierarchical and other relationships and dependencies, the function of which is to provide a standardised vocabulary for information storage and retrieval systems.

Astronomers and librarians have been experiencing difficulties in keeping up with the amount of published literature. The astronomer tries to keep abreast in his particular field and the librarian in the management, control and retrieval of scientific information. The 1980s have seen a revolution in the methods for information storage and retrieval; in particular the use of the on-line database is now well established. The speed of processing information for storage has been embraced by all but with little thought given to how we shall achieve the effective and high-precision recall of documents.

An international team of eight librarians, coordinated by Robyn Shobbrook has compiled a preliminary draft version of preferred terms in astronomy and astrophysics. The aim of the thesaurus is to standardize terminology for use in automated and manual library systems and in the allocation of keywords for scientific papers destined for publication. The keyword list has been compiled from a number of authoritative sources according to the American National Standard for thesaurus construction. It is designed to show the interrelationships, as well as synonymous terms, for a given subject, and each term has been assigned an American Institute of Physics classification number.

The librarians firmly believe the best road to success in information retrieval from automated systems is provided by vocabulary control. Contrary to belief, free-text or natural-language searching does not lead to high-precision recall. Consistency and integrity of the on-line catalogue can only be achieved with a controlled vocabulary. With today's technology it is possible to maintain the best of both worlds for high-precision recall. The controlled vocabulary is used to index the major concepts of a given document over and above the natural language used within the document.

When the IAU thesaurus has been sufficiently refereed and tested by scientists and librarians over at least the next year or two, it is hoped that the editors of the major journals will adopt the list and that astronomy librarians around the world will find they have a useful reference tool to assist not only with the input of data into manual or

automated systems but to realise high-precision recall when retrieving information. The ultimate goal will be a cost saving in time and resources for both scientists and librarians.

3.42 Discussion. In her talk Shobbrook drew attention to the costs that would be incurred in completing the project and to the need for the assistance of astronomers in checking the drafts for completeness and accuracy and in resolving the differences of opinion on the choices of preferred terms. Discussion on these and other points had to be deferred to a session of Commission 5 held on August 5.

4. DEVELOPMENTS IN DATA ARCHIVING AND RETRIEVAL

The chairman of session 3, Dr. Gart Westerhout, Director of the U. S. Naval Observatory, introduced the session by pointing out that in the past there were relatively few occasions when photographic plates were used by persons other than those who had made the observations; nevertheless it was recognised that the plates should be kept and made available for further study. Now we have the problem of what to do with the enormous quantities of data that are now being obtained directly in computer-readable form; three approaches to this problem are discussed in this session, but first there are two papers about the activities of data centres that are endeavouring to make accessible the data that have already been published.

4.1 Developments at astronomical data centres

4.11 C. O. Jaschek: Developments at CDS and cooperating data centres. In the absence of Jaschek, Westerhout read out, with interjected comments, the summary submitted by Jaschek in advance of the meeting.

Jaschek commented on each of the following common objectives of the data centres:

(a) to increase the number of catalogues;

(b) to encourage the constitution of specialized data bases;

(c) to extend the present network of data centres; and

(d) to integrate the new archives of basic observational data in the network of data centres, which hold mainly compiled catalogues.

(a) At present we have an efficient organization of catalogue exchange between the three major data centres, those in the US, USSR and France, and certain countries like the UK and the German Democratic Republic. A catalogue arriving at anyone of the three data centres is circulated to the others; the numbering system is kept uniform, so that it is immaterial to which centre one applies for data. What is less efficient is the way catalogues arrive at the data centres. One of his activities is to write to authors of long lists or catalogues to ask them to send copies of their tapes. Since manuscripts are usually produced on tapes or diskettes, it should be easy to get them, but because of the delay before he can write the letter (after the catalogue has appeared in print) he often receives the discouraging

answer that in the meantime the diskette has been re-used and that the catalogue has disappeared. This implies that somebody has to put it again on tape. Such difficulties could be overcome by better cooperation.

(b) One of the nicer aspects of data centre work is the knowledge one gains of underdeveloped areas of astronomy and of what could be done to improve the situation. When one has located such a problem area one starts looking for an expert capable and willing to do the job. This is usually a hard job, which does not always end happily. What many people have not realized is that the simple fact of collecting all information on a small part of astronomy is a powerful way to get acquainted with problems and to spot new questions. So one should encourage - and this is specially valid for locations where astronomy is developing - the formation of groups to produce specialized catalogues. Such a catalogue often also constitutes a good showcase for the activities of the group!

(c) Despite the fact that networks function across political borders, the transmission of large data sets is now done almost exclusively by mail. When a parcel crosses a national border its delivery may be delayed by customs. What we could do to minimize such problems is to create subcentres for certain regions or countries to act as distributors for their country and/or geographical region - South America, South Asia, and Islamic countries, for instance. It is clear that whenever astronomy has grown sufficiently it needs a data centre!

(d) Integration of data centres with archives is a clear tendency, which will probably be solved in a natural way through networks. It has already started with the forthcoming integration of NASA and ESA space data into the existing data networks, but it is equally clear that we should not stop at space data. We have, for instance, large archives at optical observatories and at radio and infrared facilities, and it is urgent that these be integrated too. It should become possible to know, for example, who has observed 3C 243, with what technique and when.

So in the end we may expect that towards the end of this century any astronomer may, from his own terminal, have access to all data accumulated up to now by his colleagues and his predecessors. Perhaps you might say that this is just a glorious vision, but this is what we are working for.

4.12 O. B. Dluzhnevskaya: Soviet Astronomical Data Centre. On the invitation of the chairman, Olga Dluzhnevskaya of the Astronomical Council of the Academy of Sciences of the USSR, presented a brief report on the activities on the Soviet Astronomical Data Centre in Moscow. It was established in 1981 to serve the USSR and other socialist countries, and it also provides information to other countries, such as Brazil, Mexico, Sweden, Egypt and India. Catalogues on magnetic tape are exchanged with the Strasbourg Data Centre, and a connection to SIMBAD is established about once a week. It holds about 500 catalogues, of which 32 are from the Soviet Union, including catalogues on variable stars and on star clusters and associations; extensions of these catalogues are in preparation. All the large observatories in the USSR have their own databanks, and it is hoped to

establish a computer network soon. [A short paper on "the network of the centres of astrometrical data in the USSR", by L. I. Chunseva and others at the Pulkovo Observatory, was received before the meeting, but was not presented; two of the five centres are primarily concerned with satellite tracking data (including laser-ranging data), while others hold astrometric data on stars, solar-system bodies and earth-rotation.]

4.2 New programmes for the archiving of observational data

4.21 C. R. Benn: The RGO system for the archiving of data from La Palma. Benn described briefly the principal features of the system developed for the archiving of current observational data from the three telescopes (1-metre, 2.5-metre, 4.2-metre) on La Palma for which RGO is responsible. The data archive is growing at the rate of about 10 magnetic tapes per week and it is seen as a major national facility. The tapes have FITS headers, and there is a complementary catalogue that lists the objects observed and additional information about the time, telescope, detector, and weather; this observation catalogue is accessible remotely for searching. A statistical study for 1984-86 (Benn and Martin 1987) showed that the telescopes were actually recording data for an average of about 4 hours per night and that very few observations were made at zenith distances greater than 45°. Such information is useful for assessing the effectiveness of the operational and maintenance procedures for the telescopes and it could also be useful for planning and design. Optical discs will be used for storage as soon as appropriate standards have been developed. It is also intended to extend the system to include the archiving of the reduced data. Eventually an international union catalogue of observations should be formed, and the data from past observations should be made widely accessible.

4.22 Discussion. M.-C. Lortet enquired about the identification of the observed objects and was told that about 10% of the names used by the observers were insufficient to identify the object easily. It was pointed out that most planetary observing would be excluded if telescopes were not able to reach zenith distances greater than 45°.

4.23 M. Rushton: The STScI Data Management Facility. Minick Rushton, of the Space Telescope Science Institute, said that the purposes of the STScI Data Management Facility were to provide a local archive of data from the Hubble Space Telescope and to support their distribution to other archives. The archive includes also data from ground-based observations; for example, 1500 Sky Survey plates have already been digitised. The mission is expected to last 15 years and to produce about 4.8 gigabytes per day. Optical discs provide the main storage medium. The facility will be independent of any particular device or manufacturer, and so it uses FITS standards for data formats, standard software packages and modular architecture. Much of the system is now operational.

4.24 Discussion. H. Friedman enquired whether data compression techniques were being used for image processing; Rushton answered in the negative, but said he would welcome information about them.

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4.25 F. Ochsenbein: The ESO archive project. Francois Ochsenbein, of the European Southern Observatory based at Garching, FRG, said that the main reasons for creating and maintaining an archive of the data obtained at the ESO telescopes are (a) to keep an historical record of observed objects, (b) to reuse the data for other purposes, and therefore avoiding the duplication of observations, and (c) to allow researches based on the accumulated material.

The archive is made of two parts:

1. Raw observed data, with a complete description of each image and the related calibration data, are stored on slow access media, using the FITS format (Wells et al. 1981). The media which will be used (tapes, cassettes or optical disks) are not yet defined, but could be a combination of several media. Only non-proprietary data will be available on request.

2. The catalogue of observations is organised as a data-base, and will be accessible for enquiries at the ESO computer facilities in Garching and over computer networks. This catalogue contains sufficient information to locate and estimate the suitability of archived data; it also includes the title of the observation as it was submitted and accepted.

The archiving policy recently defined at ESO (Van der Laan 1988) grants to the observing team a proprietary period of one year, which may be extended on request in special cases. The contents of the catalogue, i.e. the list of the observed targets and the title of the observing run, will however normally become public immediately after the end of the observations.

A test over one year of EFOSC (ESO Faint Object Spectrograph and Camera) observations on the 3.6-m telescope was performed to ensure the feasibility of the project. The reliability of some key parameters (telescope position, timing, target names) was checked, and some improvements in the acquisition systems will be implemented to ensure a maximal reliability of the archived material.

4.26 Discussion. In response to an enquiry about whether the weather conditions are recorded, Ochsenbein said that this is under discussion. The statement that some vendors of optical discs have claimed lifetimes of up to 200 years was viewed with some scepticism, and it was pointed out that appropriate readers might not be readily available after a much shorter period. The cost of maintaining the archives is likely to be large. Ochsenbein was closely questioned about the imposition on observers of standardised procedures for recording details of the observing runs, including calibrations; H. Dickel commented that it is clear that standard designations ought to be used for identifying the objects observed.

4.3 Designation of objects for data archiving and retrieval.

4.31 F. Spite: Problems of designation and some recommendations. Francois Spite, of the Observatoire de Paris at Meudon, said that ideally designations should be short, unambiguous and informative, but in practice short designations often proved to be ambiguous and failed

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to identify objects clearly. In SIMBAD (see section 3.11) a standard form of designation is used; it consists of a group of up to four alphanumeric characters, a space and a composite number (including leading zeros and signs where appropriate). Even this form is inadequate for multiple stars, aggregates of objects, extended sources observed in different wavelengths, and stars in clusters and in galaxies; in particular, the identification of objects in the Magellanic Clouds poses an imminent major problem.

Some negative and some positive recommendations can be made on the basis of past experience;

do not introduce a new name for an object that already has an unambiguous name;

do not abbreviate abbreviations when forming names for objects without names;

avoid strange forms of designation;

do not use roman numerals or special characters;

do give leading zeros and signs rather than spaces or no space;

do use a typeface (e.g., OCR-B) that differentiates between zero and the letter O and between 1 and the lower-case letter L; and

give magnitude scales where charts are used to identify objects.

These recommendations should be well known, but they are often ignored.

4.32 Discussion. Lyngå emphasised the desirability of keeping existing designations. The chairman then closed the session as time had run out. [A new statement of recommendations for the designation of astronomical objects (radiation sources) outside the Solar System was prepared during the General Assembly (see Trans. IAU 20B) for wide dissemination.]

5. THE CHANGING ROLE OF ASTRONOMICAL LIBRARIES

5.1 Review of IAU Colloquium No. 110

5.11 Introduction. The Chairman of the session, George Wilkins, explained that it had been decided to review the proceedings of IAU Colloquium No. 110 on Library and Information Services in Astronomy, instead of holding the panel discussion announced in the posted programme. He would review the programme for the Colloquium and at appropriate places he would interrupt the review to ask some of those present to speak about particular aspects that had not been discussed during the earlier sessions of this discussion. Each of these contributions would then be followed by an open discussion.

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5.12 G. A. Wilkins: Review of the programme of IAU Colloquium No. 110. The first session on the publication and acquisition of books and journals was opened with a keynote address by Helmut Abt on the future of astronomical literature, and then the views of publishers on the economics and pricing of astronomy books and journals were expressed by G. Kiers of the IAU publisher (Kluwer) and P. Boyce of the American Astronomical Society. Then the problems of international acquisitions were discussed by a panel from many different parts of the world. This drew attention to the problems in obtaining publications that are experienced by librarians in developing countries, as well as by those in western countries.

The second session on searching for astronomical information started with a review of different ways of choosing words for use in searching for information. The working group of Commission 5 has produced a vocabulary of terms for use as keywords. Various classification schemes are in use but these need updating regularly. A project to develop a structured thesaurus of astronomical terms is in progress (see section 3.41). Representatives of several indexing and abstracting services and of providers of bibliographic databases described their products; it was stated that Astronomy and Astrophysics Abstracts will be made available on-line by the Fachinformationszentrum (FIZ) in Karlsruhe. Techniques for obtaining the documents once they had been identified were also discussed and progress on the development of union lists of the holdings of astronomy serials was described. The techniques for the use of computer networks and electronic mail were described and on-line demonstrations of the use of SIMBAD and other databases were provided during the evenings as well as during the day.

The third session on the handling and the use of special format materials revealed the great increase in the use of preprints and the corresponding decrease in the provision of reprints and of observatory publications, particularly in western countries. It was noted that reprints and observatory publications are still considered to be of particular value to developing countries as they provide a medium for the exchange of publications with other institutions. The use of non-printed materials such as microfiche, but particularly magnetic tape, was also discussed. The fourth session was devoted to a visit to the Library of Congress following lunch in the cafeteria in the Madison Building; the introductory tours started in the parts of the main building open to the public, but then the participants in the colloquium were taken around various other parts of the Library of Congress that are not normally accessible and were given talks about different aspects of the work of the Library. Then all the participants came together again for talks on the work of the Science and Technology Division and on the optical-disc pilot project, which has demonstrated the great value of this medium not only for the storage of information but also as a means of very fast retrieval of information from journals and many other sources.

The third day began with a short session on the conservation of historical materials. A representative of the Library of Congress showed graphically how much damage is caused by improper handling of books and gave advice on how they ought to be treated. Archival activities at the Royal Greenwich Observatory and the Konkoly Observatory were described, and then attention turned to a large

variety of other library activities. There was a lively discussion on the role of astronomers in libraries and, in particular, on the relative merits of expertise in astronomy or in library science in providing library and information services. Other speakers discussed the ways in which they are using computers for a variety of jobs in libraries, such as cataloguing and word-processing, as well as for information retrieval. Problems of deciding what correspondence and unpublished documents ought to be kept, provided another topic of discussion. The provision of support for remote observatories was one of several topics that were discussed in small groups outside the main sessions, and on which brief reports on the general conclusions were given to the main meeting. A panel discussion on resource sharing and cooperative activities proved to be of great interest and it is hoped that it will lead to action that will be of benefit to libraries in developing countries. The Saturday-afternoon session concluded with a series of short summaries and reviews by the chairmen of the previous sessions, and then Pat Molholt, Associate Director of Libraries at the Renssaeler Polytechnic University, took as the subject of her closing address a look at the future of astronomical libraries; she gave the participants a dramatic illustration of the way in which computers might be used as sources of artificial intelligence as well as of information.

The last day of the Colloquium was spent at the Goddard Space Flight Center. In the morning there were several talks by members of the staff of GSFC and by other participants about various aspects of the organisation of data centers, the archiving of observational data, and access and retrieval techniques. Participants were then given the opportunity to see some of the facilities of GSFC for data activities, for libraries and for the construction and testing of spacecraft.

5.13 S. Stevens-Rayburn: The handling of preprints. Sarah Stevens-Rayburn, librarian at the Space Telescope Science Institute (STScI), pointed out that preprints are replacing reprints as the primary means by which astronomers endeavour to ensure that their papers are brought promptly to the attention of their peers in other institutions. As an aid to astronomers who wish to know what preprints have been received, the librarians at the Space Telescope Science Institute and the National Radio Astronomy Observatory (NRAO) cooperate in preparing a bi-weekly list of preprints. This list is available for on-line searching and is also distributed on a world-wide basis, either electronically or on paper. Final references are added as soon as they are known; but "preprints" that are received after the paper has been published are not listed! Institutions are requested to send their preprints to STScI or NRAO promptly.

5.131 Discussion. The ensuing questions and comments demonstrated both the general interest in the list and its value for a wide range of purposes. Each title is kept in the on-line file; many papers remain unpublished. Details are changed if it is clear that an early version of a paper has been revised and a new preprint issued. It is sometimes obvious that one paper is being submitted to several different journals in slightly different forms. A lot of work is required to maintain the file and it is not feasible to extend the amount of detail given. It

was suggested that authors should ensure that copies of their preprints are sent to the host institution when the papers use observations made on an instrument at that institution.

5.14 E. Bouton: Library support for remote site. Ellen Bouton, librarian at the National Radio Astronomy Observatory (NRAO), said that the discussions had revealed many problems in meeting the needs of astronomers at remote sites (this term also includes locations where groups are separated from the library facilities of the headquarters institution even if the place is not a remote one). The budget usually drastically limited the number of books and journals that may be purchased, and the stock is often in the care of an astronomer or an administrator who has other more pressing duties and no training in librarianship. Sometimes the HQ librarian never visits the remote site, and usually only infrequent visits are possible. There are often difficulties in getting material to the site quickly; diplomatic pouches and visiting astronomers are sometimes used instead of regular mail. The problems and the partial solutions are quite varied and the general feeling is that better solutions must be sought.

5.141 Discussion. A. E. Wright spoke of the situation at the Parkes Observatory, where there are only two astronomers on site and 2 or 3 visiting astronomers at any one time,. There are problems of space as well as of budget in holding an adequate stock of journals. He wondered, however, whether consideration has been given to replacing the printed copies by access to electronic copies. Abt said that his concept of a database for papers would provide this facility, but he considered that it was at least 10 years away. Lyngå wondered whether microfiche would be a viable alternative, even though astronomers are normally reluctant to use this medium; a good reliable reader/printer would be required, so that, for example, finding charts could be reproduced at full scale.

5.15 E. Lastovica: Resource sharing. Ethleen Lastovica, librarian at the South African Astronomical Observatory, pointed out that the essential theme of the IAU Colloquium 110 was resource sharing, but a panel of four members and a moderator had discussed resource sharing as it relates to sharing of information between those who have it, and those who do not. The reasons for not having information available when a user requires it are varied. Library and information-centre budgets world-wide are restricting the buying power of libraries, but generally, western countries are better endowed than others. Moreover, libraries in Eastern-Bloc countries, Asia and developing countries often have their foreign acquisitions restricted by currency regulations and political considerations. Several suggestions were put forward.

(a) Lists of duplicate publications not required in a library must continue to be offered to others. These lists were considered of prime importance to many libraries that have a limited stock. It was suggested that a central depository for surplus publications could be established.

(b) A forum for international exchange of information should be built up. Here it was felt that the Physics-Astronomy-Mathematics Division of the Special Libraries Association could play a role through its quarterly P.A.M. Bulletin. It was decided to circulate the next issue of the Bulletin to all who attended the Colloquium.

(c) An International Directory of Astronomical Resources should be compiled as an aid to knowing what is available in astronomical libraries and information centres. Access to these resources could then be made via interlibrary loans, or electronic mail, or in machine-readable form.

5.151 Discussion. Olga Dluzhnevskaya drew attention to the situation in the USSR, where there are about 50 astronomical institutes. Only a few of them are able to buy books and equipment from abroad; for example, the main Lenin Library has a budget of only about $2000 per year for all foreign literature, and the Sternberg Astronomical Institute is allowed only $200 for foreign books. The international exchange of books, as well as of serials, is very important for such libraries. Dockers commented that such exchanges are not attractive in the west since so few astronomers are able to read Russian. There is a move towards giving longer abstracts in English, but this is not always possible.

5.16 A.-M. M. de Narbonne: Meeting the future needs of astronomers for information. Anne-Marie Motais de Narbonne, the librarian of the Paris Observatory, considered that, although new tools, such as computers, e-mail and databases, are changing the work of librarians, even greater changes may be expected from the evolution of the needs of astronomers as a result of the introduction of new methods in astronomical research. Astronomical research and, hence, astronomical information have been expanding for a long time; astronomical libraries should have expanded as well but they also need to evolve. Progress comes more and more from new connections with other fields of science. The closer the border the more fruitful the research. Librarians can help astronomers to make these connections by providing new sources of information. These new sources can be found in specialised databases and libraries which are not organised with an astronomical point of view. The direct use of such sources appears to be difficult for astronomers, even for those quite familiar with astronomical sources of information. Librarians are generalists and information scientists, they know how to bridge the gap with other sciences.

Other changes in astronomical research include the higher and higher concentrations of instruments providing astronomical data, the increasing quantities of data, and the greater sharing of instruments and data. These changes constitute a challenge for libraries since information is more and more scattered and local needs become greater and greater. Astronomical libraries will face these new demands through closer and closer cooperation. Libraries will share information in the way that astronomers share instruments and data, so that local needs will be satisfied through the astronomical library network. The success of IAU Colloquium 110 is a recent demonstration of the common will of astronomical librarians to work in this way. Such a network needs to be set up, maintained, and improved continuously. For that purpose librarians need the cooperation of

astronomers. This implies, of course, enough money and staff because cooperation requires time and money, but above all astronomers should also be involved in this information exchange programme to make it successful. Finally, she made a plea to the astronomers present to talk to their librarians.

5.17 R. M. Shobbrook: The Astrobungler's Guide. Robyn Shobbrook gave an example of the way in which librarians are responding to the new methods of working. There have been three separate organisations on Siding Spring Mountain: the Australian National University (ANU), the Anglo-Australian Observatory (AA), and the UK Schmidt Telescope Unit (UKSTU). [There is also a small unit for the tracking of earth-satellites; the AAO has now taken over responsibility for the Schmidt Telescope.] She has produced the Astrobungler's Guide (taking the name from the nearby Warrumbungle Mountains) to give information about library-related facilities on the site (including photocopiers); the guide describes the loan policies and procedures, as well as what is available and where it is located. This guide has proved to be very popular with the astronomers on the site and with visiting astronomers.

5.2 The maintenance of the historical record

5.21 J. Dudley: the archiving of astronomical records. Janet Dudley, formerly the Librarian and Archivist at the Royal Greenwich Observatory, gave a very detailed review of problems that are associated with the task of ensuring that appropriate records of recent astronomical activities are available to the historians of the future. She also discussed briefly the conservation of those records of past activities that have been kept. (An extended summary of her presentation is given separately after this report.)

The basic problems are organisational in character because very few astronomical institutions have adequate systems for controlling the large amount of paper that is produced. In some cases papers are regarded as the private property of the scientist concerned or the papers concern more than one institution; in such cases it is very easy for documents that would be of great interest to be lost. Then it must be noted that there is a very large variety in the types of records that are generated: correspondence, records of meetings, descriptions of equipment, legal records, results of observations, and many other types. In some cases the records may not necessarily be on paper; they may be on magnetic tape or even as three-dimensional models. It is important to have a policy about what is to be kept and not merely what may be thrown away. It is necessary to consider whether the aim is to preserve the information or the document itself. It must be recognised that documents may have to be kept for varying periods before a final decision about whether to keep or reject them may be taken; hence there should be a regular schedule for the review of papers. There should be a consistent policy about what should be kept and the policy should be a neutral one: records of failures as well as successes should be kept. It is important that the persons carrying out the appraisal of the documents should keep a record of what has been done and of why particular decisions have been taken. Such a policy should ensure that the records that are kept will have long-term value. Particular problems arise when the information is generated or stored on magnetic media such as tapes and discs; it is probable that the archivist will

need to transfer such information into new formats in periods of five to ten years to ensure that the information remains accessible. Many documents are copied on to microform in order to reduce the amount of storage space required but, as yet, it is not known how long such materials will remain readily legible. Many documents produced in the 19th century are decomposing rapidly because of the acidic nature of the paper. Even today many important documents are not produced on archival quality paper.

It is also necessary to consider how best to ensure that the documents remain accessible to prospective users. It is not sufficient merely to store the documents, they should be listed and indexed so that the information in them can be retrieved. Each institution does have the responsibility for looking after its records; it has to bear in mind that once a document has been destroyed it is lost forever, while a decision to keep a document is also a decision to incur further expense. Such decisions should not be left to chance.

5.22 Discussion. Wayman stated that the IAU does have a policy of keeping its records. Abt said that he wanted to throw away the records of the Astronomical Journal when he took over, but this was compared to burning the library at Alexandria and the University of Chicago decided that the records should be archived. Even now, many consider that the reports of referees are confidential and should not be archived for others to study later. Referees are therefore given the opportunity to indicate whether or not they are willing for their reports to be kept. At present 200 000 sheets accummulate each year and he had found it necessary to rent a storage locker in Tucson. At that point the chairman decided that the time to close the Joint Discussion had come, and he thanked all those who had contributed by presenting papers or by participating in the Discussion, and he expressed the hope that all participants had found the Discussion to be of interest and value.

6 SUMMARY

6.1 Overall view

The Joint Discussion brought together many astronomers, librarians and other specialists who would not normally attend the meetings of Commission 5 and it led to a valuable exchange of information and views about new developments in astronomical documentation and information services. In this respect it achieved its principal objective. It is hoped that this report will be read by an even wider community and that others will be encouraged to use the new techniques and facilities and to contribute to their development. It is too early to judge whether the Joint Discussion achieved its ultimate objective of bringing about a closer relationship and better understanding between the providers and the users of these new astronomical services.

The contributions and discussions showed clearly that the new techniques are potentially of great value. In some cases, however, further development and evaluation is required before it will be possible to recommend their widespread adoption. Some of the benefits,

problems and tasks that were identified during discussions are highlighted in the following paragraphs. The list is by no means complete, but it should provide a guide for future action.

6.2 Publications

The transmission of copy by national postal services is subject to unjustifiable delays and losses in some cases, but it is unlikely that reliable computer networks will be available to replace the post in all countries in the near future.

The transmission of copy in magnetic or electronic forms may save time, but there is a need for standardisation of procedures and format.

The availability of the IAU Style Manual should make it easier for conscientious authors to produce copy in a consistent style, but copyeditors will still be necessary if publishers are to maintain high standards in their journals and books. More effort should be made to encourage astronomers to use the existing recommendations that are intended to give greater clarity and precision in the specification of physical quantities, in the statement of bibliographic references and in the designation of astronomical objects.

6.3 Retrieval of bibliographic references

The SIMBAD database is a powerful new tool for the retrieval of information about astronomical objects, and there is a heartening prospect that Astronomy and Astrophysics Abstracts will soon be available on-line for the retrieval of references. Many astronomers will, however, need more guidance about the availability and techniques of use of these and the many other databases from which they may wish to retrieve references of interest to their work.

The development of an IAU Thesaurus should provide a useful aid to improve the completeness and precision of retrieval of information; assistance from astronomers is required to ensure that the thesaurus is up-to-date and reliable.

The astronomical community should also take action to revise the Universal Decimal Classification scheme 52 for astronomy in order to ensure that librarians and information specialists are no longer forced to use an incomplete and misleading scheme when indexing astronomical books and papers.

6.4 Communications

General-access computing services and electronic-mail, using the networks that now connect many astronomical institutions, will revolutionize both the general distribution of information and the communications between individual astronomers. The procedures need to be simplified and greater uniformity in addressing systems is desirable. Directories of organisations and individuals need to be extended, and they should be made available on-line as well as in printed form. The needs of institutions that are not connected to these networks must not be overlooked.

6.5 Numerical databases

The development of a system of large astronomical databases at a few centres, such as Strasbourg, Washington and Potsdam, continues, but the new networks will make possible general access to specialist databases that are each held at only one institution. The prompt archiving of new observed and reduced data in digital form will make such data available to much wider communities than in the past, when the main storage media were the photographic plate and eventually the printed page. Such systems could be used at small observatories as well as at the major observatories and institutions, but the full benefits will only be obtained if common procedures for access can be developed.

6.6 Designations

The failure of many astronomers to follow the IAU recommendations on designations when compiling new lists of objects, or when referring to objects in published lists, is a matter of considerable regret. There is a need for greater vigilance by editors and referees, but this is not sufficient. Astronomers must be convinced of the value of following the recommendations. More effort is needed to develop a general system that can be applied in an appropriate manner whenever new types of object are discovered, when new techniques of observation are introduced, or when new major surveys are made.

6.7 Libraries

The availability of desk-top computers, communications networks, and major databases has already had a major impact on the work of many librarians. These new facilities have both aggravated and compensated for the diminishing budgets of many libraries. They also both require and make possible greater cooperation between librarians in different institutes. Commission 5 should play a greater role in stimulating and assisting such cooperation, and especially in ways that will assist librarians in developing countries.

The maintenance of the historical record of the activities of an institution is still an important task but very rarely is direct provision made for it. This task often falls to the librarian who must decide or recommend what is to be kept and take steps to see that the documents as well as the library books are conserved for posterity. Commission 5 in cooperation with Commission 46 should do more to provide guidance to librarians on this specialist task. They will need the support and assistance of astronomers if a full record of the activities as well as the results of 20th century astronomers is to be kept for posterity.

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