REPORT OF DISCUSSIONS

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A. EXISTING DATA CENTERS

In connection with the paper by Mead, videodisks were mentioned as a recommended storage medium, as they have a long lifetime, can store graphs, and are inexpensive to reproduce. Vette commented that magnetic tape now available also is quite durable.

Heck responded to the question how the data will be preserved: Several copies of the IUE images on magnetic tape are presently maintained around the world: Two or three by NASA at different centers, one at Rutherford and Appleton Laboratories, and one at Vilspa. Each agency is responsible for finding the best way to preserve its data set. Lyngå noted that the information storage on microfiche is very efficient from the viewpoints of packing density and of durability, but the major difficulty currently is in the automatic film reading, for which a technique need be developed. Vette confirmed that no reliable method is yet available although work on this potentially important method progresses. Davis pointed out that the creation of large quantities of machine readable observational data is not limited to spaceborne instruments. For instance, many of the instruments now being used at the Mount Hopkins Observatory of the Center for Astrophysics record on magnetic tape, accomodating the annually growing rate of produced data. It was also noted that the astronomical storage needs are not extreme. Even the data from the Space Telescope will be less than what weather and Earth satellites supply.

Schmitz added to his presentation on the cataloguing of infrared objects that coordinates are assigned from original sources as referenced, or else by measuring approximate positions from published maps. When working in the near-infrared (690 to 890 nm), McCarthy noted that many of the positions are already found in Dearborn Observatory catalogs, some also from Case Observatory and in ApJ 242, 938 (1980). Westerhout inquired about the recording of extended and multi-peaked sources. Schmitz will provide maps for these 10% of the catalog entries.

C. Jaschek and W. Heintz (eds.), Automated Data Retrieval in Astronomy, 311–322.

Westerhout (responding to an inquiry by Vette): The most accurate method of determining polar motion is currently from the averages obtained by the Bureau International de l'Heure (BIH), this being the only "standard" reference system at hand. However, at the level of consistency of the BIH data, both connected-element interferometry and the laser ranging data show systematic trends which are similar. Probably the most precise method is Radio VLBI, but nothing is known yet about its systematic effects.

Comments resulting from the discussion of the Sedmak/Santin paper on ASTRONET: Presently only the system located in Bologna is in operation. National and international links are planned to be added as soon as the other systems will become operative. The network is funded by the participating institutions and from a grant from the Government of Italy. Two or three simultaneous graphics users are anticipated, and the software standards are not yet defined.

Discussion following the paper by Locke centered on the availability of data in form of published catalogs. Concerning the possibility to combine data from various satellites, even from different wavelength langes (Heck): Yes, it is intended to compile the data, as they become available from different satellites, and to tag them according to different parameters, such as source, wavelength, specific time, and others as may be of interest to requesters. Schmitz inquires if the NSSDC agreement includes classified data. Locke: All users are encouraged to submit their data; several projects have been unclassified and sent to the Center. McCarthy commends the colleagues at NASA, NOAA, and NSSDC for efficient data accessibility, in his case connected with the weather survey of a new observatory site. The material was usually readily obtained, or at least the reference where to get it.

The Faint Object Camera was the subject of Macchetto/Perryman. What is the cosmic-ray background rate (Vette) ? The effect of low-energy electrons and protons will be minimised by shielding. Certain other events will be recognised as particle-induced by the pattern-recognition unit. Events that escape this recognition will, however, give rise to one count only in the final image. Figures are available from NASA on the particle-event rate which is a function of the orbital position. Like other Space Telescope instruments, the FOC will be switched off during periods of high background rate. - What is the status of projects on the processing of data to come from the HIPPARCOS astrometric satellite (Heck) ? The Announcement of Opportunity for offers to reduce all data gathered through the lifetime of HIPPARCOS has been recently released by ESA. Two independent consortia will be selected, and all of the data be forwarded to them. The reduction is expected to result in a final astrometric catalog, containing positions, proper motions, and parallaxes for all program stars, perhaps two or three years after termination of the mission. A more complete overview of the scientific coordination of the HIPPARCOS project (launch expected in 1986) has been published by Perryman in the Bulletin d'information CDS Strasbourg, no. 21, p.40 (1981).

In the discussion following Terashita's presentation, Mead described the astronomical database retrieval at NASA-GSFC: The basic retrieval program keeps the catalogs in their original format. For each individual catalog the computer program contains these formats and retrieves the entire entries based on catalog identification numbers. This was found to be more satisfactory than rearranging catalogs to fit some standard format, in particular because all catalogs differ with respect to arrangement and contents. Thus compatibility is hard to achieve if it is desired to retain all of the catalog data.

B. DATA NETWORKS IN ASTRONOMY

The report on EURONET led to the question whether connections with different national networks are expected. Salle feels that this appears to be doubtful. EURONET can be considered as the triggering factor toward a joint European network, and its future will depend on the success of the participants in linking their networks together.

De Pablo had this comment to the paper by Carnochan: An excessive proliferation of private or domestic networks for the astronomical data interchange seems to be evident. The solution of the particular interlinking problems is effort and time consuming. Quite often the adopted solution is to take methods, protocols, and even a specific hardware model of one manufacturer. Promotion of common methods of data exchange and software production could be one of the tasks of IAU in the future. Such methods should be manufacturer independent and internationally acceptable. As Wilkins explained, one of the reasons for the decision to link the six computers on STARLINK was to encourage the development of common software. Information about new software, as well as the programs themselves, are easily passed over the links. Much more cooperation and less duplication appear to have resulted than would have been the case with independently installed computer systems. Subsequent discussion showed serious problems to result from the software incompatibility between various systems. The question if the calling of programs at various places would jam lines (Heck), was answered by Carnochan: Sending information to and from several machines simultaneously will not jam lines since the system connecting the computers will be able to avoid that. But certainly the low speed of the lines does mean a serious degrading of response times once a certain amount of traffic and of users is exceeded.

C. NEW HARDWARE

Perryman comments on the high recording speed offered by holographic video systems. In particular, it would be quite useful to record digital speckle images in this way. For example, 50 frames of a 500 x 500 x 16 bit photon-counting system per second could be recorded digitally with such a system, and this corresponds to a recording rate of 25 megabytes/s.

D. RECENT SOFTWARE DEVELOPMENTS

Albrecht emphasized that the software production for the Space Telescope is deadlined. Thus he cannot afford to wait for a standard format, such as that being developed for STARLINK, and mentioned by Wilkins. In response to Terlouw, Albrecht explained that the Virtual Array approach is also for machines without mapping hardware; the image is mapped by software. This is certainly less efficient, and cannot be made as efficient as would be possible in theory, because of the trade-off between speed and user-friendliness. Should a program using Virtual Arrays be found to lack the speed perhaps necessary for certain purposes, some parts can be replaced. The question arose (Polechova) if the conversion of photographic data to tape or disk was limited to plates, excluding copies like the Palomar Survey prints. Albrecht has for the PDS microdensitometer an "opaque sample option" available. It can also be done with a video camera, since positional accuracy is not that important, especially when paper prints are digitized. Such video digitizers operate already in quite a few institutions, and should be common in the near future as their prices diminish.

McCarthy agrees with Eichhorn's discussion of positional precision and accuracy, and would like to have heard the word "standards" also with respect to the photometric systems.

Bijaoui elaborated on the proposed handling of his - surely voluminous - catalog. At each request for a field the Data Center provides a tape. It is easy to update, thus maintaining completenesss of the catalog. Davis addressed the problem of extracting photometric information for stars and galaxies when they are comparable with, or even fainter than, the background. Bijaoui pointed out that a second problem goes with that, viz., the separation of objects in crowded fields. Many good algorithms have been developed for the latter task, but they will not work very well on too faint objects (m>20), compared with the background. Crowded fields require a good signal/noise ratio and flawless images.

Albrecht asked Mistrik about the suggested improvements in planning of the project life cycle, and in particular the advocated compiling requirements. This is fine if the user is an airline or a bank. In research the requirements analysis is very difficult, and the scheduling of a project which pushes the state-of-the-art is close to impossible. Mistrik agrees that to compile requirements is quite difficult for anyone but the researcher himself. A careful analyst would target certain areas to be questioned, and would divide the field into sub-areas which can be classified as generic, group specific, and special, in order to question at least in the generic area. Major decisions in the other areas are left to the researcher. In smaller research projects the researcher is better off compiling requirements himself, from practical viewpoints, although the analyst will be able to help through transforming them into precise specifications.

In response to several questions, Stein described the selected star catalog: It is essentially a subset of the SAOC and should therefore show the same star distribution and galactic concentration. Most positions and proper motions are directly from SAOC, a few from AGK3. The 5°x 5° fields do not have the same centers as those of the ESO/SERC survey. Double stars not resolved by the sensor are eliminated as they give an incorrect centroid. Therefore also the magnitude information (to indicate doubles) needed not be retained. The software generating the mission catalog and associated tasks, such as star retrieval from mission records, can later be made available (as Warren suggested); at this time the documentation is still incomplete. Carnochan described an automatic arrangement of several catalogs merged with the SAOC in strips of 1° of ecliptic longitude for a UV experiment.

Lavrov uses the term "table" as meaning "relation" in a relational database, and can readily separate tables for any object type.

Warren: The services of the Data Center are offered to the entire scientific community. The information is circulated through the Astronomical Data Center Bulletin, published as needed (semiannually or so); observatories and astronomy departments in the Americas and selected institutions worldwide are on the mailing list. Specific catalog subsets (mission catalogs) can be generated from detailed specifications, provided that the number of requests and the time needed to develop ad hoc software will not be excessive. Data are at intervals corrected for errors discovered by users. It was intended to inform individual users about errors in the material they had received; but this large job will have to be done through the Bulletin.

E. BIBLIOGRAPHIC SERVICES

Following his Invited Paper, Schiminovich states that category headings only have been devised so far while classification of papers has not begun. The periodical publication of the computer-generated index, suggested by Warren to aid authors in classifying their papers, would amount to the use of algorithmic techniques as tools for the design and support of classification systems, and would be a welcome development, short of complete implementation of the automatic techniques for the actual processing of the papers.

Commenting on the paper by Laloe, Jaschek asks that authors be encouraged to get their bibliography on tape as soon as possible. Longer lists of objects in publications have to be bodily referred to as "lists", though there is no consensus on the minimum number of objects which would make a list.

A machine readable version of the Astronomy and Astrophysics Abstracts (AAA) and the loading of their back issues onto bibliographic services was suggested, but is not available. The subject of key words received discussion here and at special Working Group meetings.

Collins: Efforts are made to add identifiers of objects besides coordinates, to list alternative spellings, and to recognise certain abbreviations. Papers may be scanned for additional designations and names not in the title, although for not more than 10 objects.

F. COPYRIGHT

Guerassimov cited his paper as an example for non-exclusive copyright: Although to be published by Reidel, it is work for UNESCO and thus may be used by anyone. It has not been decided whether computer programs are protected by copyright law or by patent law (question by Wilkins), though the majority opinion appears to prefer copyright law as being the most appropriate. Carnochan expects that the "economic" side of copyright will soon be sorted out. It is becoming economical for publishers to hold their journals in full text on computers. The scientist will be able to log into the computer and to receive immediately the article he requires. In this manner the publisher will receive the royalties which he does not get from photocopying papers. Such schemes are currently as inexpensive to operate as services such as the supply of requested papers by the British Library. One process whereby material is placed onto videodisks uses a filming technique. Thus scientists may want to be a bit careful when signing away the film rights to their work.

G. EDITORIAL POLICIES AND NOMENCLATURE

The discussion explored a variety of items addressed in the Invited Paper by Lequeux, in particular, in which way the traditional publication of data and their storage in centers might best complement one another. Jaschek felt that journals should not be charged with the publication of long catalogs, for instance, lists with more than 500 entries. These could go into observatory publications or directly into datacenters, with only a summary published in periodicals. Some IAU Commissions have advised against this policy. Worley - working in the production, compilation, and use of data - feels dissatisfied with the editorial treatment of data in several journals even now. The reading of older journals shows discussions and analyses which often are outdated, even appearing irrelevant and quite naive, yet together with data which still remain useful. Present editorial policy should not go toward continuing deemphasis of data in the journals, or else the short lifetime of papers will suggest an alternative way of reducing costs, i.e., to print on cheap newsprint stock - with the advantage that shelf space is saved as journal volumes self-destruct in a reasonable time.

To insist on all of astronomy in one journal seemed to Jaschek to be just a habit from history. The main journal of Astronomy and Astrophysics, for instance, could be split into specialised publications which cover smaller fields. Subscribers almost always use only a small fraction of the contents, but pay for all of it.

The problem of object designations can, Jaschek believes, be solved with the aid of the master list of catalog abbreviations prepared by Spite and co-authors, and nearing publication. Editors can refuse scripts containing obscure and unexplained designations if the referees do their work properly. Lequeux said that editors naturally cannot examine papers for compliance with IAU recommended nomenclature (for instance, the new denotation for clusters adopted recently by Commission 37, and mentioned by Lyngå); this is the reviewers' job. Jaschek also supports the trend toward camera-ready manuscripts. With the mean life of a paper of less than a decade, there is no point in much elevated expenses merely for a bit of esthetics. Eichhorn recommended the incentive of a reduction of page charges for camera-ready papers, instead of an accelerated publication.

Carnochan mentioned word processors as an alternative production method besides typesetting and camera-ready copy. Each article is essentially typed once only, including corrections and redrafting on the word processor, and can via computer linkup be used directly as input to the computer typesetter of the publisher. Since the paper is machine readable at all stages, abstracts can be early dispatched to the terminals of abstracting services, which saves time and work for them also.

One Working Group of IAU Commission 5 is preparing a vocabulary which should help toward unification of the key-word lists in use (Lantos). Another WG is trying to get a bit of homogeneity into the rather disintegrated policies sometimes imposed by publishing firms, and some of the subjects addressed in the extensive discussion (of which only a selection is reproduced here), following the paper by Lequeux, will have to be taken up again at the next IAU conference.

Following the suggestions in the paper by Spite and Ochsenbein, Mead emphasized that double designations - a long-standing IAU recommendation - are still very important since errors (and loss of the data) may arise in databases owing to typographical errors in single designations which cannot be checked. As reiterated by Commission 5 in 1979, coordinates are acceptable identifiers with a clearly specified equinox. Heck reported similar identifying requirements adopted by IUE, viz., 1950 coordinates plus an identifier, and if the latter is not from a major catalog ("exotic"), a written evidence from the literature. New running numbers are sometimes introduced in catalogs when there is really no need for them as identifiers; they merely complicate retrieval. The Catalogue of Stellar UV Fluxes used only HD or DM numbers or (in their absence) 1950 positions (Carnochan). The numbering of stars in clusters will be the subject of a Commission 37 resolution at the next General Assembly. Worley warned of problems which may additionally be introduced by standardized designations into an already confused field. Some codes are already ambiguous, and younger astronomers attempting to interpret the older literature will be confused by codes since eliminated. - Since the discussion on nomenclature arranged by Commission 5 in Montreal, some scientific commissions have taken up the matter, and the hoped-for coordination will be to the benefit of data efficiency.

The need for nomenclature rules, clear enough so that they can be applied by every astronomer, seemed to be agreed on. This was discussed at several past meetings like the present one, as Mead pointed out, and in order to start a standardized numerical nomenclature right away, it was high time to finalize such rules. Opinions were divided, however, whether identifiers be assigned by the individual astronomer or by an agency, such as a data center covering the subject area. The needs are that a name be unambiguous, be available as soon as possible, and be expected to become a permanent, useful identifier. It may be possible to wait for an official name while there is a preliminary designation, consisting of the discoverer's code and list number, and accompanied by the coordinates and the full description of the object, in order to avoid confusion and to clarify the type of object; as an exclusive identifier system, however, discovery list numbers are clearly unacceptable (Polechova). The risk in this procedure: Preliminary designations, intended to be temporary, will be perpetuated by inertia. The use of the Nomenclature Booklet by Lortet et al should help authors to avoid confusion. Warren urged that new catalogues be prepared using a homogenized, new designation system, but that every effort be made to cross-identify objects with previous designations; otherwise any new system would be impractible to use. Vette cautioned not to be too optimistic, from experience in information from artificial satellites; as long as there are various groups working on the same objects - spacecraft or stars - there will be aliases.

Additional difficulties arose with the nomenclature of extended objects, on which Polechova had reported. The size of the object serves as a second identifier, although not entirely independently as revised size measurements may modify the precision of the identifying position. Polechova stated that the information on the range of dimensions is simply and expediently a byproduct of the naming system; the information about frequencies is deemed necessary and, besides, already widely used. The cross-identifications of objects including corrections are considered the most useful advance in her already published catalog of H II regions, and this progress should be preserved (and extended to new designations) in the computer readable form of the catalog of extended objects. NGC 2024 is an example for gross confusion when names are assigned without well-defined agreement. The preference for galactic over other coordinates as identifiers received several supporting comments from the audience. Objects with uncertain positions, such as X ray sources, pose a problem similar to that of extended sources. Designations were revised between the 3U, 4U, and Einstein Observatory catalogs as positional accuracy improved. Dickel distinguished two modes of operation when observing the interstellar medium: (a) targets identifiable by types and (galactic) coordinates in surveys and catalogs; (b) studies of a given region such as the Orion Molecular Cloud. For the latter kind a different sort of designation is described in the Nomenclature Booklet (Lortet, Fernandez, and Spite) and may appear a bit cryptic, but again, there are two identifiers to be quoted. In general, one should not attempt to put too much of information into the identifiers, lest they may become impractical (Vette).

Fernandez asks that word be spread about the forthcoming compilation of existing catalog designations, expected to be published as a special Astr.Astrophys.Supplement. The authors have purported to follow the common procedures found in recent literature, and introduce new abbreviations only when there are already duplications. The request is made that, for any input sought to dictionaries and compilations, contact name, addresses, and input requirements be widely circulated.

The Catalog of Stellar Identifications (CSI) described by Ochsenbein is commended by Heck as a basic and reliable reference for difficult identifications as are frequently needed in operating the IUE satellite. The faint end (V > 13) of the CSI has a very patchy coverage of the sky, as stars are added from individual papers rather than from faint star surveys. This fact will need caution for some tasks, e.g., finding charts (Carnochan).

H. DATA IN ASTRONOMY

The discussion following the Invited Paper by Hauck was mainly concerned with the suggested filing system for photographic archives. Vette considered the informational aspects of the proposal quite tractable and analogous to space science procedures (observatories corresponding to spacecraft, telescope and accessories to missions, and plates to data sets). Albrecht described a set of computer programs at Vienna Observatory for plate cataloguing. The master file holds all the archival data, up to 30 parameters, including the few basic data Hauck had mentioned, but also plate scale, air mass, and others. An interactive data entry program and a printout utility allow to generate lists according to specific parameters (objects, coordinate limits, etc). Programs for sorting and for more sophisticated searches are expected to be added later. The archival system is written in Fortran IV; documentation and programs are available to interested persons upon request. A master file maintained at a data center, Albrecht continued, should certainly be as simple as possible for reasons of storage as well as file maintenance. In is quite unfeasible to request the maintenance of all conceivable data on a data center file. Once a researcher has located the potentially useful plates, more detailed information can be obtained by contacting the local plate archive system. Hauck announced that further consultations will take place on which items of information are required, and which others formatted but optional (as not all archives may be able to readily supply them). The preferred coordinates are α,δ 1950.0. The record should show if a plate is out on loan at the time of a second request. Since most request concern a certain object (star), priority attaches to developing computer lists of plates by object. For spectral plates, McCarthy suggests, the dispersion should be included with the basic sorting parameters (α, δ, name, m_V, date/time, plate number). Wilkins mentioned the problem of keeping photographic plates over long periods of time. Royal Greenwich Observatory would like to hear about work or techniques for extending the lifetime of plates, and for copying them economically while ensuring that their information contents is not

degraded. McCarthy suggested consultations with curators of old plate collections, e.g., Carte du Ciel files. A mysterious malady called Gold Mold has recently been discovered, to which the important Kodak type III emulsions are subject. It may be related to changes in the fixing solutions.

Copying Schmidt plates without impairing quality was also addressed by Tritton. McCarthy commended the generosity in sharing the research materials with the whole astronomical community. Good positional precision seems to have been obtained from glass copies of ESO plates. The 8-parameter filing system of Benacchio was criticised by Albrecht who pointed out that many more parameters were advisable, so that the vital data are at hand without the need for frequent recourse to other sources such as observing logs.

The plates used in the study by Janes were Kodak IIaO and IIaD from a KPNO 91 cm telescope, scanned with a PDS at Yale. The accuracy obtained was encouraging; McCarthy referred to a recent paper by R. Albrecht (Ric.Astr.Spec.Vat. vol.10, p.9, 1980).

The suggestion by Egret and Jaschek, that the astronomical community should encourage the preparation of good catalogs and compilations, prompted this comment by Spite: There are prizes for papers; why not create an award, even symbolic, for the best catalog or compilation of the year? Carnochan mentioned that, with present videodisks and optical disks, very long term storage is possible by permanently burning information into the surface by laser; one such system, using computer-connected videodisks is already operational in the United States. Vette recalled a study by the Information Processing Division at Goddard Space Flight Center on the lifetime of magnetic tape storage, giving a much better result than many people have been led to believe: About one bit error per tape per year developed.

The new IDS catalog (Worley) will be in tape version only, and should be available through CDS and other centers in 1982. McCarthy mentioned new spectroscopic results and techniques (Michigan Survey, SIT Vidicon and Reticon as receivers in slit spectrographs). The catalog of clusters of galaxies (Nottale) has not yet advanced beyond the compilation of literature, and the circulation of a first draft is at least one year away.

The coordinate accuracy of extragalactic objects in available general catalogs is good enough for safe identifications, according to Paturel, so this material could be the nucleus for the central file. Cross-indexing with other object codes (for instances, radio sources) is not considered at this point.

The current catalog of galaxies (Kogoshvili) is in a computer form not adaptable to foreign computers; the new version now in preparation will be readable on IBM 360-line (800 bpi, 9 tracks, used code ABCDF), and should be ready for distribution by the end of 1981.

Jahreiss had this data breakdown for the 4597 stars which are candidates for inclusion in the FK5:

176 stars (4%) have trigonometric parallaxes determined,
937 stars (20%) have UBV photometry,
837 stars (18%) have MK spectral types,
1035 stars (23%) have radial velocities.

Basically there are records which software is available and where, though the detailed program documentation for outside use often is not (Grosbol). Computerisation problems may have already come up, and been solved, in different applications (as discussed between Lyngå and Davis in connection with open-cluster data); so it should pay to look around for potentially useful software. Very tough problems to tackle are storage of identification fields and cross-identification of extended objects with correspondingly uncertain positions.

I. DATA IN SPACE ASTRONOMY

NASA Stellar Data Center (NSSDC) has four periodic publications, as Vette summarized in response to Heck: The Report of Active and Planned Spacecraft and Experiments (RAPSE), the Launch Summary, and the NSSDC Data Listing are produced annually. RAPSE provides brief descriptions about spacecraft and experiments, about 1 paragraph in length, and identifies relevant personnel (Pricipal Investigators or Project Scientists). The Launch Summary includes all satellites and rockets in a given year; for the rocket launches the type of experiment and name of investigator are stated. The Data Listing is a one-line catalog of all NSSDC holdings, including ground-based data, environment models, and computer codes. The other periodic report is the monthly SPACEWARN Bulletin that provides information about recently launched or decayed satellites, as well as beacon frequencies and other parameters for satellites which are tracked optically. In addition, reports of studies, bibliographies, program summaries, and data books are published at various times. Some of the publications described by Mead and Warren at this Colloquium appear as NSSDC/WDC-A-R&S documents. Other activities at the NSSDC include a Satellite Situation Center, an Energetic Particle Environment Assessment Office, and recently the Science Operation Planner function for the Dynamics Explorer mission has been taken on. All of these activities include the preparation of data in special ways for individual missions.

Since packet telemetry is likely to be adopted for scientific satellites in the foreseeable future (de Pablo), packets and messages will have to be organized for the scientists and common elements arbitrated. Current plans at Goddard Space Flight Center also give appropriate attention to the archving aspect. Hauck was interested to learn about the fraction of costs of the NSSDC documentation and dissemination of satellite data for science in terms of the total mission expenses. Vette estimated that in the case of NASA-funded science experiments about 5% to 10% of the total cost go into the analysis of the data.

NSSDC represents about 2% of the funds used by NASA to support data analysis. In some cases it also serves as an archive for data from cooperative satellite missions with other countries, and for some experiments funded by other US government agencies.

GENERAL DISCUSSION

Among the speakers summarizing their impression of the overall significance of the Colloquium, Mead noted the progress made in the wide and expedient availability of catalogued data. The 1976 conference had brought together many astronomical experts with problems and efforts in their respective subject areas, while presently the growing participation of data-handling experts provided increased know-how toward solutions. Heck emphasized the necessity to update catalogued data with respect to errors detected. Corrections should be published in cumulative form, and - in doubtful cases - the catalog version stored or used will need to be specified. He also expect more interfacing use between space and groundbased astronomical data. Worley addressed the problem of identifiers; he warned against proliferation of designations, recommended universally used identifiers, and defended the right of the IAU to endorse such identifiers as requisite for expedient documentation.

The wide ranging scope of this Colloquium, from software and datacenter operation to abstracts and patents, was appreciated in the summary by Heintz. The Working Groups in IAU Commission 5 have service and "watchdog" functions in these areas, and the coordination toward which they work should help counteract disintegration of subject areas within the IAU as well as cross-discipline. The Guidelines presented by Wilkins and other coordinative documents mentioned at this conference deserve wide attention; Kleczek is putting final touches on the revision of the Astronomical Dictionary, and the IAU is represented in ICSU, CODATA, the Abstracting Board, and other organizations. Problem areas are the data flux in view of hardware incompatibilities, divergent needs in data documentation between subject areas, the pros and cons of data publication versus storage, and the search for optimum cost-efficiency in data management which includes careful assessment of allowable redundancy.

Jaschek and others mentioned the use of positional catalogs as identifier sources (inventory lists). SAOC and AGK3 are most demanded. For this purpose the completeness of SAOC leaves something to be desired and a replacement should be considered, in view of the large amount of work already invested in positions and proper motions of fainter stars, and of the plate material still being measured. Inclusion of bibliographical references in materials for data centers is certainly desired. In closing, Hauck expressed satisfaction over the increasingly useful function of data centers and networks. The skepticism of a few years back about their feasibility in astronomy has long been replaced by appreciation of the success of an activity, the growth of which is far from ended.