Report of the 1st Meeting of the WFI WG Organising Committee

The first meeting of the Organising Committee for the Working Group on Wide Field Imaging was held at the Space Telescope Science Institute in Baltimore, USA, on 13–14 April 1992. Those present were:-

Full committee members:

J. Guibert	H.T. MacGillivray (Secretary)
R. Humphreys	D. Malin
K. Ishida	I.N. Reid
B. Lasker	M. Tsvetkov
H. Lorenz	R. West (Chairperson)

Invited consultants:

G. Burdsall (representing KODAK)
J.-L. Heudier (as past Chairperson of the WG on 'Astronomical Photography')
R. Kron (to provide input on CCD sky surveys)

Burdsall and Kron were only present for the first day of the meeting. Heudier was able to be present throughout.

1. Welcome and Opening Discussions

Lasker welcomed everyone to the STScI. He pointed out the importance of WFI in present-day astronomy, how the situation in both ground-based and space-based astronomy owed much to the availability of wide-field data. He cited the Hubble Space Telescope as a specific example which depended heavily for its support on scans of the plate material from the Schmidt Telescopes. There were tremendous opportunities ahead, with the availability now of second epoch photographic sky surveys from the Palomar, UK and ESO Schmidt telescopes and with the advent soon of deep wide-angle surveys using CCDs.

West thanked Lasker for his welcoming remarks. He congratulated the committee members on the fact that everyone had been able to attend. He regretted the small, as yet, proportion of female members on the committee, but hoped this would be remedied in the course of time. West reiterated that this was a unique occasion, with a newly formed WG on a topic which encompassed all wide angle astronomy, and he looked forward to the successful workings of the OC and of the WG itself.

West then gave a general introduction to the WG on WFI, its background and its goals. The WG had been established at the 1991 General Assembly of the IAU in Buenos Aires under Commission 9. It had a mandate for the forthcoming 3 years, and hence had the opportunity to show its worth. West saw 4 main activities for the WG:-

1) integration (of techniques and science);
2) coordination (e.g. of the photography and CCD groups);
3) standardisation (procedures, formats, archival media, etc.);
and 4) dissemination and sharing of information to the larger community.

On the last point, West noted that a Newsletter of the WG had been started, and this would be the main forum for the dissemination of information. The Newsletter would be distributed twice yearly (the first issue having been released in January 1992). There was subsequent unanimity among the OC members that the Secretary should encourage contributions highlighting the science coming from WFI as well as the expected contributions on the technical side.

There followed some further discussion on the scope of the WG in 'Wide-Field Imaging'. There was general agreement that the WG should incorporate imaging in the (near) infra-red, since as pointed out by Kron the scientific goals and techniques are very similar. Spectroscopy is another area with overlap, and it was agreed that objective prism spectroscopy should fall within the remit of the WG. In essence, any activity that provided (2 or 3-D) imaging of more than a single source at a time could legitimately be regarded as a 'survey' type activity and could fall within the scope of the WG.

2. Sky Surveys and Patrols

2.1 Overview

West provided an overview of 'Sky surveys and patrols'. Basically, the distinction between a 'sky survey' and a 'sky patrol' is that a survey is multi-coloured, goes very deep, is done at high resolution and is only performed a small number of times (i.e. once or at most twice to provide second epoch information). In this way, the sky survey provides a stable record of the sky. A patrol on the other hand is only performed in one (or at most 2) colours, does not go so deep, is done at low resolution and is performed frequently so as to 'capture' rapid changes of the sky. The main sky surveys to-date are those produced by the Palomar, ESO and UK Schmidt Telescopes, while the main patrols to-date are those of Harvard and Sonneberg. Some 700,000 photographic plates are now available as a result of the latter patrols. The use of CCDs on small telescopes for future sky patrols now appeared practical. However, West emphasised that photography was not a thing of the past when it came to sky surveys, and we must ensure the continuation in the future of the major Schmidt telescopes and photographic sky surveys.

Concern was voiced as to the continuation of the photographic sky survey work on the major Schmidt telescopes. Reid pointed out that support for the Palomar Schmidt cannot be guaranteed after the POSS-II sky survey is completed. Malin pointed out that the scientifically useful life of the UKST was not infinite, that it was perceived as vulnerable in some quarters and that its funding may cease when the AAO agreement came up for review. There was a strong reaction from the WG members to work to support the continuation of the UKST.

Malin voiced a further two concerns, namely the move of 4m telescope facilities away from providing support for prime focus photography, and the fact that the new class of 8m telescopes currently under construction had no capability to undertake photography altogether. Malin regretted both of these moves. He also stated that there was a misperception amongst young up-coming astronomers that photography is 'old-fashioned' and obsolete. On the contrary, there were a number of very good reasons for the continuation of photography on large telescopes. Reid made the point (which received no objections) that the astrometric capabilities of the photographic plate were not matched yet by CCDs and would not be matched for a considerable time to come.

Burdsall warned the OC regarding the dangers of cutting the need for specialised, on-glass photographic materials. He indicated that KODAK were taking a close look at the needs for photographic material from 1995 onwards, and if there was a move to reduce the production of the materials, then it would be very difficult to reverse that decision at a future date. He urged the OC to use caution with regard to any decisions concerning the reduced usage of photographic materials.

2.2 CCD Surveys

Humphreys provided a review of the present state of CCD surveys. Their main advantages were in the linearity of the detector, the fact that they were easily and accurately calibrated and that they were fast and reached faint limiting magnitudes. Their main disadvantages were the (as yet) small area covered and the fact that to be efficient there was a need for rapid on-line reduction of the data. As yet they were no substitutes for the photographic plates, but would take on an increased rôle in the future.

Humphreys described the main surveys currently in operation or planned. In the US, there

were currently 2 sky surveys underway: at the Steward Observatory and at the USNO (Flagstaff). These were on small dedicated telescopes. In the UK, the Cambridge group were proposing a survey of the NGP using an array of 6 2048 x 2048 CCDs on the INT, while the Hitchhiker Parallel CCD Camera (University of Wales) was already permanently installed on the WHT 4.2m telescope, but as yet only operating in serendipitous mode. In Japan, experiments were already being undertaken with an 8000 x 8000 CCD mosaic on the Kiso Schmidt telescope with plans to eventually have a similar system operational on the Japanese 7m telescope.

Two future projects in particular were highlighted:-

a) that of the NASA Spaceguard survey, a programme for the rapid detection of near-Earth objects;

and b) the Sloan Digital Sky Survey of the North Galactic Cap.

The latter, in particular, is an ambitious project aimed at imaging (in 4 colours) and spectroscopy (~ 1 million galaxies down to r ~ 18 mag) of ~ ¼ of the sky starting in 1995.

The presentation stimulated much discussion. It was seen that there was a lot of commonality between the requirements of the photographic plate digitisation community and of the CCD community. Indeed, Kron made the point that it was possible that the workings of this WG could assist the CCD community since algorithms of interest (e.g. star/galaxy separation) and data handling capabilities had already been developed specifically for the large databases derived from the photographic plates. Kron suggested that much of the code could perhaps be used very easily without modification.

In the course of the discussions, other areas of complementarity between photographic and the proposed CCD sky surveys became apparent. The main problem with the photographic sky surveys was that the colour information was not contemporaneous. This, therefore, caused a major problem when attempting to differentiate between objects of varying intensity and objects of genuine extreme colour. CCDs can get contemporaneous colours, but the problem is that since the CCD surveys are new, the history of any strange object is not known. The major photographic sky surveys can provide information on the history of each object, which is vital for variability and proper motion studies.

The main perceived problems in this type of work are common to groups working in both areas, viz. the archiving, processing and analysis of very large quantities of data. A future proposed workshop focusing on techniques would be beneficial, and help secure interaction and links between persons working in the two main types of sky surveys.

Kron was invited to become a full member of the OC in order to provide input on the CCD sky surveys.

2.3 Space Schmidt Project

Lorenz described the Astrophysical Schmidt Orbital Telescope (ASCHOT). This is a collaborative project between the Byurakan Astrophysical Observatory (Armenia) and the Central Institute of Astrophysics in Potsdam (Germany). The aim is to build a wide-angle UV Space Schmidt Telescope in order to undertake a full UV sky survey and to provide a comprehensive study of UV emission from extragalactic and galactic objects. The telescope would reach a limiting magnitude of 24 for stellar objects at a wavelength of 1500 Angstroms.

2.4 Re-establishment of Sky Patrols

West pressed for the re-establishment of sky patrols, which would be aimed at recording the sky at frequent intervals. He considered that it would be timely now to invest effort in investigating the parameters for a future dedicated patrol-type instrument. Reid was sceptical about the need for such an instrument. He felt there was no clear scientific case for such. He continued that the need for such an instrument should be driven by a clear scientific goal, and that the requirements of that science should dictate the design characteristics of the telescope. Kron added that the best way

forward to make a scientific case would be to take the best examples of projects benefitting from high frequency observations and to use these to work out the design parameters that would be required to optimally achieve those projects. West was invited to provide a more detailed proposal for discussion at the next meeting.

3. Photographic Techniques

3.1 Overview

Malin gave a comprehensive overview (graphically illustrated with the use of slides) of the importance of photography in wide-field imaging. He pointed out the further gains to be made with the use of the new fine-grain films on both the UKST and the AAT and pressed for the further refinement of those films by KODAK. The potential inherent in photographic enhancement techniques and in new fine-grain film revealed very clearly that photography was definitely not a thing of the past. There were quite obvious advantages in the use of fine-grain film for future sky surveys.

Malin said that problems of loading film (as opposed to plates) in the UKST had now been solved, but that possible effects of distortion needed to be examined. Malin pressed for the WG to set up a Working Party to study the integrity of the films for astrometric purposes. He suggested that comparisons should be undertaken between scans on glass plates and films to quantify any effects of e.g. stretching of the films, stability, etc.

3.2 Interaction with Suppliers of Photographic Materials

Malin pointed out that there were 3 salient points regarding the characteristics of new photographic materials:-

1) speed, contrast and resolution;
2) spectral sensitivity;
and 3) choice of base material.

Regarding these points, there was thus a list of items he wished to be raised for discussion with KODAK:-

a) the possibility of an extreme high-contrast emulsion (with a gamma of 5) for the detection of very faint objects;
b) the provision of fine-grain emulsions that would conform to the more commonly used passbands (U, B, V and R);
c) the possibility of non-hardened 4415 emulsion on a glass backing.

After discussions, it was agreed that:-

1) Malin would be the point of contact between the astronomical community and KODAK.
2) KODAK agreed to investigate the possibility of supplying a blue-sensitive Tech Pan-type emulsion.
3) Malin would undertake tests on some existing emulsions that KODAK would place on glass.
4) The WG would arrange for 'dealerships' for the purchase of photographic materials from KODAK.

Finally, in summing up from the KODAK point of view, Burdsall said that he was happy from these discussions that the astronomical community was still interested in continued supply from KODAK, and that there was no large-scale migration away from the use of photographic material in the foreseeable future. He would report these conclusions to the most senior level at KODAK.

4. Digitisation

4.1 Overview

MacGillivray described the present situation regarding the digitisation of the sky survey material. There had been 2 recent meetings on the subject of 'Digitised Optical Sky Surveys', the first at Geneva in May 1989 and the second in Edinburgh in June 1991. The proceedings of the latter meeting had been published by Kluwer.

There were several groups around the world in the process, or in various stages, of completing scans of the major sky surveys:- APM, APS, Muenster, STScI, COSMOS and USNO. There was a certain degree of complementarity in these scanning activities, in that US groups were prevalent in the Northern sky while non-US groups were prevalent in the Southern sky, although there was also some overlap. Basically, the demands from science or needs of a major support programme were driving the scanning programmes. Plans to make the data available to the astronomical community were advanced: the STScI were making (lightly) compressed pixel data available on CD-ROM disk, while the catalogues of the POSS-I survey were accessible at the APM and APS groups. The COSMOS group was intending to distribute its catalogue from the UKST 1st epoch survey on CD-ROM.

There was some concern that the current machines are not extracting the full information content of the photographic plates (positional information present at ~0.3 micron scales, the machines accurate to only ~1 micron and a density range of 5 [100,000:1] available on plates, but machines only digitising a 0-3 [1000:1] density range). Also, concern had been raised at the Edinburgh DOSS meeting that sampling intervals needed to be about 10 microns or smaller, in particular for the scanning of fine-grain films. At the present time there had necessarily to be a trade-off between scanning speed, dynamic range and pixel size.

New initiatives had come from the availability of fine-grain films (which had shown several advantages over the IIIa emulsions) and from the results of digitally stacking several tens of plates of the same field. These had highlighted the potential for new science from usage of fine-grain film on the Schmidt telescopes.

A number of issues were raised:-

a) what plates should be digitised (all plates or only the survey plates? What about the objective prism plates?);
b) some machines may be optimised for specific projects/specific types of plates; should there thus be better coordination of who does what?
c) the groups will be distributing catalogues for user consumption: should we undertake a comparison of the machines to ascertain the integrity of the catalogues thus released?;
d) should there be standardisation, e.g. of distribution medium, parameters, formats, conventions (e.g. equinox 2000)?;
and e) what should be the rôle of the data centres in all of this: should the groups act as the providers and supporters of their own data, or should the data centres do this?

In the ensuing discussions, comparison of the machines for internal 'standards' was considered important. Accordingly, MacGillivray was assigned the task of obtaining suitable plate material and circulating it around the various participating groups. Reid volunteered to be the adjudicator if there was sufficient interest in carrying out such a comparison.

With regard to formats and conventions, etc. it was decided that the data was necessarily machine specific and it would not be sensible to impose constraints, especially if these might be impossible to meet. However, the groups were encouraged to adopt IAU conventions (e.g. nomenclature, equinox, etc.) wherever appropriate.

4.2 Overlays for Sky Surveys

Lasker raised the issue of film overlays for the sky surveys. There had certainly been great

enthusiasm for the overlays in the past, but there were now no funds to support their production. West was of the opinion that the way ahead should be the computer way, and that it would be necessary to provide digital overlays with the scanned sky survey material. Lasker was urged to investigate whether overlays could be provided with e.g. the STScI CD-ROM distribution of their PDS scans.

5. Archival and Retrieval of Wide-Field Data

5.1 Overview

Lasker initiated the discussions on archival and retrieval of wide-field data. His main themes were:-

1) the purposes of archiving;
2) the materials to be archived;
3) what requires IAU-level cooperation;
and 4) how can the community access the archived material.

On the reasons for archiving, Lasker pointed out that there was an overriding need to preserve the information from the photographs, which was now more important because of the deterioration in some of the existing photographic plates (e.g. due to gold spot disease). There was also a requirement to allow the community access to quantitative data from the plate archive for the furtherment of science.

Regarding the materials to be archived, Lasker listed 4 categories:-

a) the plates themselves (obviously required for posterity);
b) the raw pixel scans from the machines;
c) the object catalogues produced from the scans;
and d) the deep data produced from digital stacking and CCD mosaics.

On the archive medium, Lasker pointed out that magnetic tape was now not an option due to much higher density and more compact alternative media. At present there was a strong reliance on exabyte and other forms of helical media, although optical disk and optical film media were now evolving rapidly. Lasker considered that the way ahead for long-term archival recording was with the optical disk technology. He suggested that at the next conference, we had presentations from experts on both the tape and disk devices.

Concerning what needs IAU cooperation, Lasker pointed out that IAU conventions were generally accepted but not always used. Instead, the need to stay close to the data rather than the sky dictated the use of site specific ad hoc conventions. Lasker thought that the issue here was not desperately important, but nonetheless merited some consideration.

On the user access to the archived material, Lasker thought that there could be a universally available facility for catalogue searches, and suggested that there should be further community discussion on the best way forward. At present, users had access to scan materials at the scan centres. This was often the best approach, but was relatively costly. Scanned data was being exported by various groups and this is a successful activity at the present time. Perhaps the logical way forward for very large data sets was by means of network access to the scanning centres, and Lasker suggested that the DOSS/WFI community might be able to drive the global growth of broad-band, full service network connectivity.

West pointed out that the IAU (Commission 6) had discussed how information could be more easily transferred between astronomers. It was quite obviously an aim of the IAU that all astronomers have access to networks. Networking is, however, a major problem in parts of Eastern Europe. Nonetheless, it was seen to be very important to improve scientific activities by means of satellite links, and West thought that money would become available to help out. West said that if this WG

felt there was a need to transfer catalogues by means of network links, then this would provide further support to Commission 6. Very soon all countries should have reasonably good connections and hence the WFI data could be more easily transferred.

5.2 Wide-Field Plate Archive Data Base

Tsvetkov outlined the history behind the Wide-Field Plate Archive database. It had been initiated at the 21st General Assembly as resolutions A8 and C11-14. There had been previous work carried out to survey the Wide-Field Astronomy instruments and plate archives. Tsvetkov's aims were now to undertake a comprehensive survey of such instruments and plate archives and to put the information into computer readable form. Tsvetkov had arranged a list of 143 Wide-Field telescopes which were used for professional work, and for these information had been obtained on:-

a) the size of clear aperture,;
b) the aperture of the mirror;
c) focal length;
d) telescope type;
e) field of view;
f) year of start of operations;
and g) elevation of site above sea level.

On the list of existing plate archives, Tsvetkov had distributed a 1st circular letter to over 200 observatories and institutes in September of 1991. He had received 63 replies, and from that he had drawn up a list of the existing plate archives. The information he had obtained regarded the type of material (plates, glass copies, films) and the number of plates (direct and objective prism). Also noted were whether the catalogue information was in computer readable form. His results indicated that there were in existence over 1.3 million wide-field plates.

Tsvetkov outlined his plans for organising this information. He intended to have completed his survey by 1992/93. From this he would create a computerised database sometime between 1993 and 1996. The database would have a range of information on the plates:-

1) observatory and telescope used;
2) plate or film;
3) sky coordinates of field centre;
4) size of plate or angular extent on sky;
5) time of exposure;
6) a list of plate-specific details (e.g. length of exposure, direct or objective prism, multiple or single exposure, hypersensitisation, type of emulsion and filter used, etc.).

There would also be information on availability of the material, whether it had been digitised, whether copies of the data existed, etc.

Finally, Tsvetkov described an ambitious aim to have the entire WFI plate collection digitised. He envisaged that such a project should take from 2.5 – 5 years to complete on a low-precision digitiser, and that there would result some 1000 terabytes of information. This would be the ultimate in preserving the information content of the photographic plates.

While there was clear support amongst the OC members for Tsvetkov to produce a database of the plate archive material and to make that list of plates available, it was not generally accepted that there was a need to digitise the entire plate collection, unless there was a strong case, such as for example deterioration of a set which might lead to a complete loss of a valuable record.

Malin made the further point that although institutions had lists of plates, this did not necessarily mean that the plates were available. Experience had shown that some scientists had not returned plates after borrowing and that the plates were lost to the community. Malin urged the OC

to make a strong statement that astronomers should return the plates to the originating institute after use.

The discussions thus stimulated a number of resolutions:-

a) Tsvetkov was asked to identify platers which were stored in a bad way, and hence at risk;
b) The WG should assist institutes that do not have databases of their plate material and advise them on how to create the databases;
c) The OC should make every effort to see to it that plates were returned. It was suggested that this could be brought to attention through the Newsletter.
d) We should start the same enquiry with groups acquiring large-scale CCD frames with a view to organising a similar database based on digital material.

6. Organisational Matters

6.1 Definition of 'Wide-field'

There was considerable debate as to what constituted a 'wide' field and what did not. Should there be an angular size cutoff? If so what should that cutoff be? Small-sized CCDs (e.g. 512 x 512) might not constitute wide fields, but then perhaps the larger CCDs (8096 x 8096) would? Objective prism surveys should be included but what about multi-slit observations? Due to the difficulty in reaching a decision on the matter, the Secretary was commissioned to 'word' a suitable definition. [*Note added:- the Secretary has suggested that any observation involving simultaneous observation (direct or spectroscopic) of more than a single object in the optical or infra-red can be legitimately regarded as 'Wide-Field Imaging'*].

6.2 Relations to the CCD World

Throughout the 2-day meeting it had been accepted that the OC was 'weak' on the CCD side. This had been rectified by inviting Kron to join the OC to represent the CCD community.

6.3 Communications

6.3.1 WG Newsletter

Comments were invited from the OC members as to the form of the Newsletter. These were fully positive. Further suggestions as to what might go into the Newsletter in the future were made. There was quite general support for more shorter contributions. The editor should seek articles from various groups which would describe what they are currently doing in the area of WF astronomy. Small items of news and information would be valuable. Lists of references to articles being produced would also be helpful, as would lists of the most recent major publications from the different sites. Generally, the idea of the Newsletter as a rapid means of information dissemination was formulated.

6.3.2 Electronic Newsboard

The idea of creating an electronic newsboard as a means of disseminating information had been proposed. It was not clear to the OC members that at this stage this would serve a useful function. There were difficulties of it being managed properly. Also, it was generally felt that the Newsletter served this function better and provided more of a 'personal touch'.

6.4 WG Membership

The WG currently had some 170 members. This was considered perhaps large in WG terms. The Secretary affirmed his intention to keep the list of members 'active', and this would be distributed fairly regularly.

6.5 WG Structure

On the whole, the WG structure was satisfactory. However, we should seek to establish better representation from the CCD community. The areas of expertise in data handling, archival etc. were also seen as lacking, and steps should be taken to build up the membership from persons having such knowledge.

6.6 Action Plan and Priorities 1992-94

The most immediate item was to arrange for a meeting of the WG as early as possible. It was accepted that this could not be done before 1993. The OC should also, however, prepare for a session at the 1994 IAU General Assembly being held in Amsterdam. Details were left to the next OC meeting, which would be organised to coincide with the WG meeting in 1993.

7. 1993 Conference

Ishida conveyed to the OC members the formal invitation from B. Hidayat to combine a 1993 WFI meeting with the proposed meeting on Schmidt Telescopes in Indonesia, also to be held in 1993. This was welcomed by the OC. However, it was felt that a meeting in Indonesia would prohibit many WG members from attending due to the expense and time taken to travel. The OC decided to decline Hidayat's invitation at the present time, but requested West to write to Hidayat to thank him for the invitation and to indicate the possibility of a meeting in that area at a future date.

Both Minnesota and Potsdam had been suggested by OC members as possible venues for the 1993 WFI meeting. Expressions of interest were thus invited from representatives of the possible host institutes. Humphreys favoured a smaller meeting which would involve both the photographic and CCD communities but which would focus more closely on techniques for data processing, analysis etc. It was the opinion of the majority of OC members, however, that they would like the 1993 meeting to be much broader in scope and allow presentations on both techniques and the science. The conference centre in Potsdam was capable of housing a large gathering. Accordingly, it was decided that the 1993 meeting be held in Potsdam. A further meeting on more specialised topics could subsequently be arranged for circa 1994-95 in Minnesota.

The programme for the 1993 was worked on at length. It would be a 4.5 day meeting with the following structure:-

Day 1: sky surveys and patrols;
Day 2: data archival and processing;
Day 3: Solar system studies [*Note: ½ day*];
Day 4: Galactic studies;
Day 5: Extragalactic studies.

Areas of responsibility among OC members were assigned as follows:-

Day 1: West, Malin, MacGillivray and Kron;
Day 2: Lasker (+ 1 expert on data processing) and Tsvetkov;
Day 3: Guibert and Heudier;
Day 4: Reid, Ishida and Humphreys;
Day 5: MacGillivray and Lorenz.

There was general support for the move to have the emphasis on review presentations, although contributed papers were also welcomed. There would be the capability for demonstrations. The OC would be the SOC for the meeting; Lorenz would arrange the LOC. The proceedings would be published by a commercial publisher (probably Kluwer) and in a format similar to the 1991 Edinburgh DOSS meeting proceedings. The editors would be the representatives of the 4 WG subgroups, viz. MacGillivray, Lasker, Malin and West.

8. Summary of Decisions and Resulting Action Items

West summarised the main decisions that had been reached during the meeting and the action items which had resulted:-

8.1 WGWFI Goal

The WG should seek to integrate both the techniques side of WF astronomy and the science that gets done. WFI should encompass both the optical and infra-red region of the spectrum due to the similarity of the techniques used.

8.2 Continued Support for the Large Schmidts

There is concern to ensure the continuation of the Large Schmidt telescopes and the valuable survey work they are undertaking.

8.3 Prime Focus Photography

Photographic possibilities have been reduced on many 3 – 4m class prime focus facilities. We must ensure that the capability is kept in place, at least on some facilities. The problem with astrometry using CCDs must ensure the continuation of photographic sky surveys, at least for the time being.

8.4 Interaction with 'Wide-Field' CCD Work

Kron to become a member of the OC (and of WG). He will ensure liaison between the WG and the CCD-mosaic community.

8.5 KODAK Products

a) Malin to become WG spokesman and sole tester of new products.
b) Malin and KODAK to prepare well-founded, detailed proposal for institute 'dealership' in order to facilitate distribution of KODAK products.
c) Burdsall to investigate whether U+B+V type 4415 emulsions can become available.
d) Burdsall to get KODAK to remove hardener from glass-based 4415 emulsion in order to allow better sensitisation.
e) Burdsall to investigate whether extremely high contrast fine-grain emulsion can be made available for deepest possible photography.

8.6 Digitisation

a) WG to investigate optimal pixel size for digitisation:- 5 – 10 microns?
b) WG to elaborate detailed test scheme to help digitisers recognise strengths and weaknesses of their machines + software; astronomically-oriented tests to be preferred (i.e. alpha, delta, magnitudes of objects), stability, etc. MacGillivray to obtain and distribute plate material, Reid to specify details of test and undertake the evaluation, assuming community interest in such an activity.

8.7 Value of Photography

The WG reconfirms great value of photography in astronomy for at least another decade. However, there is a desire for new and better emulsions. CCD and photography are complementary. WG to inform astronomical community about the strengths of photography and its superiority in certain areas.

8.8 Overlays

Lasker to investigate possibility of computer-based overlays, i.e. as well as the CD-ROM digitised images there would be identifications for objects in the field. He will discuss with J. Mead.

8.9 Presentations on Tape and Optical Disk Technology

WG to arrange for talks on tape and optical disk technology for the 1993 meeting; also how to keep digital archives and most suitable archival medium. This is an evolving technology.

8.10 CCD Archive

WF to impress upon the CCD community that they must archive their data.

8.11 Recovery of Plates

WF to press for recovery of plates on loan to astronomers. WG to suggest ways of persuading them to give the plates back to the archive.

8.12 Archives at Risk

Tsvetkov to draw up a list of observatories/institutes at which plate archives appear to be in danger of being irrevocably lost. WG to find ways to salvage such plate archives.

8.13 Nomenclature

WG recommends the use of IAU conventions where possible, while recognising the need for machine-specific designations in preliminary catalogues.

8.14 Data Centres

Persons from NSSDC, Strasbourg, etc. to be invited to 1993 WG meeting.

8.15 Objective Prism Plates

Prism plates lie within the jurisdiction of the WFI WG. West will inform E. Griffin of this decision.

8.16 Definition of Wide-Field

Observations which use multi-plexing capability.

8.17 Newsletter

MacGillivray continues as editor for next 2 years. Situation to be reviewed then. Articles to be short. Encourage progress reports and 'newsy' items.

8.18 Newsboard

Not needed (yet).

8.19 Future Meetings/Conferences

1993 meeting to be held in Potsdam with dates 23 – 27 August. A smaller meeting to be arranged in Minnesota (for 1995?).

8.20 Schmidt Telescope Meeting

West to write to B. Hidayat to thank him for the invitation.

9. Closing Remarks

The business of the meeting having been concluded, West thanked Lasker and the STScI for their hospitality over the previous 2 days. The meeting had been highly successful and West pointed out there was much to be done in the future. He looked forward in particular to the Potsdam conference which would be a marvellous opportunity to bring the entire WG together.

H.T. MacGillivray
Secretary to the OC