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## MIDAS Memo

ESO Image Processing Group

### 1. Application Developments

In this summer release of MIDAS a great step towards hardware independence has been achieved: First, the AGL library from ASTRONET is now used by all graphics applications in MIDAS. The metafile oriented AGL package already supports a lot of different graphic devices and backend drivers for other devices may be added easily. Second, all image display applications of MIDAS are now based upon a proto-type of the IDI\* interfaces. An actual implementation of the IDI interfaces has been done at ESO for the DeAnza IP 8500 and also at Trieste for an EIDOBRAIN 7001. The concept of these IDI routines was successfully tested in Trieste. We implemented MIDAS on the EIDOBRAIN machine by simply replacing the DeAnza IDI interfaces with the IDI interfaces of the Trieste group!

A set of commands for reduction and analysis of one-dimensional spectra is now available. For a long time this was a main missing area of applications that

\* Image Display Interfaces which have been presented at the Data Analysis Workshop at ESO in February 1986.

was not considered until now due to the excellent performance of IHAP. The commands use AGL as standard graphics package. Functions included are wavelength and flux calibration tools and some interactive analysis facilities. More developments are expected in this area in the near future.

Another area of activity was the fitting package. New methods are now available to perform Least-Squares approximations to images and tabular data.

### 2. Distribution Policy

The distribution policy for MIDAS has been revised to ensure a better service for the growing number of users at other institutes. The basic scheme has been modelled after the concept used by AIPS. There will be two major releases of MIDAS taking place January 15 and July 15 each year, i.e. this July release is denoted 86JUL15. In addition, minor releases will be made April 15 and October 15 when required. New reduction packages and significant modifications will be distributed with major releases while minor ones will contain bug-fixes and small enhancements only.

The release tape contains installation procedures, help files and MIDAS code needed for generating the system except commercial libraries. All application programmes are available in FORTRAN source code, whereas monitor and libraries are distributed as object code for VAX/VMS, since parts of the latter code may be written in other languages. Source code as well as executable images and test files are available on special request. Two special libraries are needed for linking MIDAS, namely: NAG for mathematical routines and AGL for graphics. The latter can be obtained through ESO or directly from ASTRONET.

A request form for MIDAS releases was sent to all institutes on our present tape mailing list in early June. Other institutes which would like to use MIDAS

are kindly requested to contact the Image Processing Group in ESO directly. The MIDAS distribution kit is provided free of charge to all non-profit research organizations. New releases will be mailed automatically if we have received the returned distribution tape at least one month prior to the release date.

### 3. A Portable MIDAS Version

Most new computers are offered with the UNIX operating system which has been adopted also by major European vendors. In order to provide MIDAS for such systems (e.g. workstations), a portable version of MIDAS will be developed. This version will run under both VAX/VMS and UNIX, and be upgraded with real-time features for data acquisition and network capabilities. The design specifications will be presented to the community in the fall of this year while a release is expected in the spring of 1988.

### 4. Computer Upgrade

The main scientific computer facilities of ESO were upgraded at the end of June to meet the growing demand from users. The VAX 11/780 and VAX 11/785 computers are replaced by two VAX 8600 machines increasing the total performance by more than a factor of 3 to 8.4 MIPS. The I/O performance of the system is also increased by a second SBI bus on one VAX 8600 computer and the use of faster Winchester disk drives from System Industries. Further, a VAX station II/GPX was purchased for image processing applications. This workstation runs UNIX and will be used for the first implementation of the portable MIDAS version under UNIX. The computers are interconnected with a Local Area Network which uses Decnet protocol between DEC equipment and TCI/IP for communication to other systems such as HP computers and measuring machines.

## Remote Control of 2.2-m Telescope from Garching

G. RAFFI and M. ZIEBELL, ESO

A Remote Control (RC) run of the 2.2-m telescope at La Silla was carried out from Garching during six observing nights in the period March 23–29, 1986. This was the next logical step after the test run of La Serena in June 1984. The instruments used, each for 3 nights, were the Adapter with CCD and the Boller & Chivens with CCD, so that the

astronomers involved had a chance to work both with images and spectroscopic data.

The RC concept implemented and tested in this run is what we call "Interactive Remote Control", to point out that the user works at the computer consoles with the same degree of interaction available as in the 2.2-m con-

trol room at La Silla, without the need to have a fixed and predetermined observing programme.

### The Telephone Link

The RC set-up consisted of two HP 1000 computers, one being the control computer of the 2.2-m telescope at La

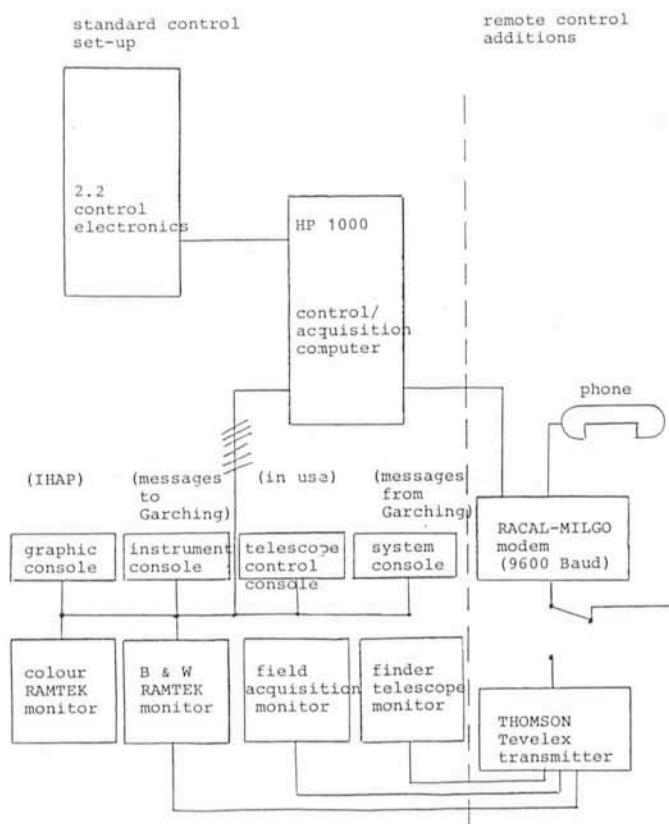
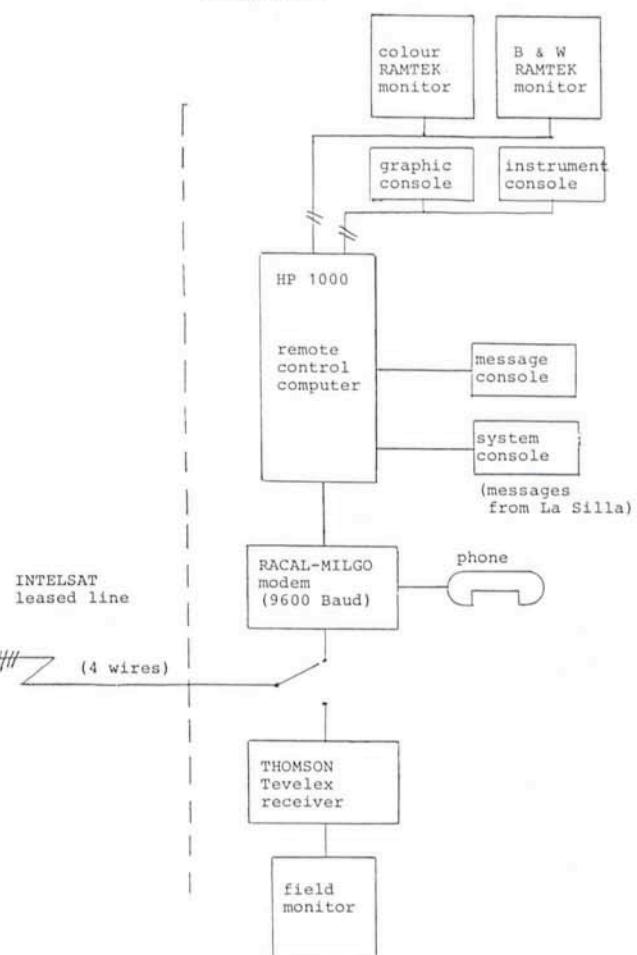
LA SILLA 2.2M TELESCOPE  
(REMOTE SITE)GARCHING SET-UP  
(LOCAL SITE)

Figure 1: The complete remote control configuration. One can see that the telephone line is time-shared between digital- and analogue communication, this last both for telephone and TV monitor frames.

Silla (remote computer), and the second being located at Garching (local computer = near the user). They were connected via a leased telephone line, with a standard bandwidth from 300 Hz to 3.4 kHz, available full-time to ESO during the test period. The telephone line consisted of the following trunks (starting from La Silla):

- a 500-m cable from the 2.2-m telescope to the Chilean Post repeaters at La Silla,
- a microwave link between La Silla and Santiago,
- a satellite link on Intelsat over the Atlantic up to Raisting, FRG,
- a leased ground line from Raisting to Garching.

The line was a 4-wire line, conditioned (equalized) in Munich and Santiago, to provide a good-quality transmission. The digital communication was via 2 modems, with adjustable speeds up to 9,600 baud, belonging to ESO. To have own modems is allowed on a leased international line and solved the prob-

lem of different "quasi-compatible" modems, which is what one would get asking the German and the Chilean Post to rent modems. The communication was point-to-point, full-duplex and the protocol used was HDLC. The communication software used at system level was DS/1000 from HP, and the ESO software was developed over it.

### The System Configuration

Figure 1 gives a complete picture of the RC configuration. It shows how the leased line was shared, so that it was possible to have telephone communication and analogue image transmission in addition to digital data transmission, by means of a manual switching procedure. In particular, telephone conversation was possible via special telephone sets connected to the modem.

Another possibility offered was the use of a system built by Thomson for the transmission of analogue video frames. This system was used in conjunction

with the field acquisition monitor and finder telescopes to send a reduced TV image to Garching in a very short time.

It should be noted that the use of the line in an analogue way (either for telephone or for video frames) was an alternative to computer communication. So this could only be done when no data transmission was going on, but otherwise it did not have other effects on computer operations, which could continue unaffected at the end.

### The RC Software

One aim of the RC software was the possibility to offer exactly the same interface to the 2.2-m telescope instrumentation from Garching as from La Silla (e.g. same softkey menus and forms as on the 2.2-m instrument console). It was, however, preferred to leave the control of the telescope via the telescope control console to the night assistant at La Silla, following the usual practice of work sharing at the tele-



Figure 2: The remote control room for the 2.2-m telescope in Garching. 1 = messages from La Silla, 2 = messages to La Silla, 3 = modem, 4 = TV images receiver, 5 = field acquisition TV monitor, 6 = phone, 7 = Ramtek monitors, 8 = instrument console, 9 = graphic console, 10 = hard copy.

scope between night assistant and astronomer.

Figure 2 shows the RC room for the 2.2-m telescope in Garching. Figure 3 shows how the RC software was implemented. At the top the ESO control/acquisition software is shown, where the control functions, dealing with the interfaced electronics and user end part, are implemented in separate packages. The two parts communicate via mailboxes. This was done some time ago having RC control in mind.

For RC a remote mailbox mechanism was implemented over the DS/1000 software. This allowed us to keep the controller programmes totally unchanged. They communicate under RC via a link – rather than a normal – mailbox with the user end programmes. On the user side, while the user end interface was kept unchanged, some interface subroutines had to be added.

## Data Flow

Following the data flow in Figure 4 one sees that data acquisition was done on the control computer of the 2.2-m

telescope (according to commands sent from Garching). Afterwards data were sent from La Silla via a compression/expansion package to Garching. Data went directly from an image processing (IHAP) file at La Silla to a corresponding file in Garching, with an option to display them on an image display monitor. It should be underlined that this activity could go on in parallel both with the sending of new commands or with local image processing in Garching. This means also that transmission times were much less noticeable than if the user had been idle and waiting.

## Results

- The leased line, once set-up and equalized, was reliable and stable in time.
- The line was operated at 9600 baud for data transmission.
- Transmission times for a full CCD frame (around 170KW) took about 10 minutes, which is some 40% worse than the net throughput of the La Serena test. This is not due to an increased error (and therefore retransmission) rate, but simply to greatly increased transmission delays.
- On the whole, the line (including modem and computer cards) was adjusted with the main aim to have it working reliably. This was successfully achieved: there were no hang-ups.
- Typical data transfer times were however smaller than the times given above: 7 minutes for images, 2.5 minutes for spectroscopic data. This is because data compression/expansion was applied and, for spectra, only the relevant part of an image was sent. Data were sent in these times complete, i.e. without loss of information.
- Data transmission times could be reduced even more, applying cut levels and division factors in the compression algorithm, but in practice one never felt so time critical that this should be done.
- The good pointing of the 2.2-m telescope helped a great deal, so that no field monitoring was needed for direct imaging. In spectroscopic mode, field acquisition TV frames were sent via the Tevelex device. This is capable of sending a TV frame, reduced to 50% (every other line) in 25 seconds.

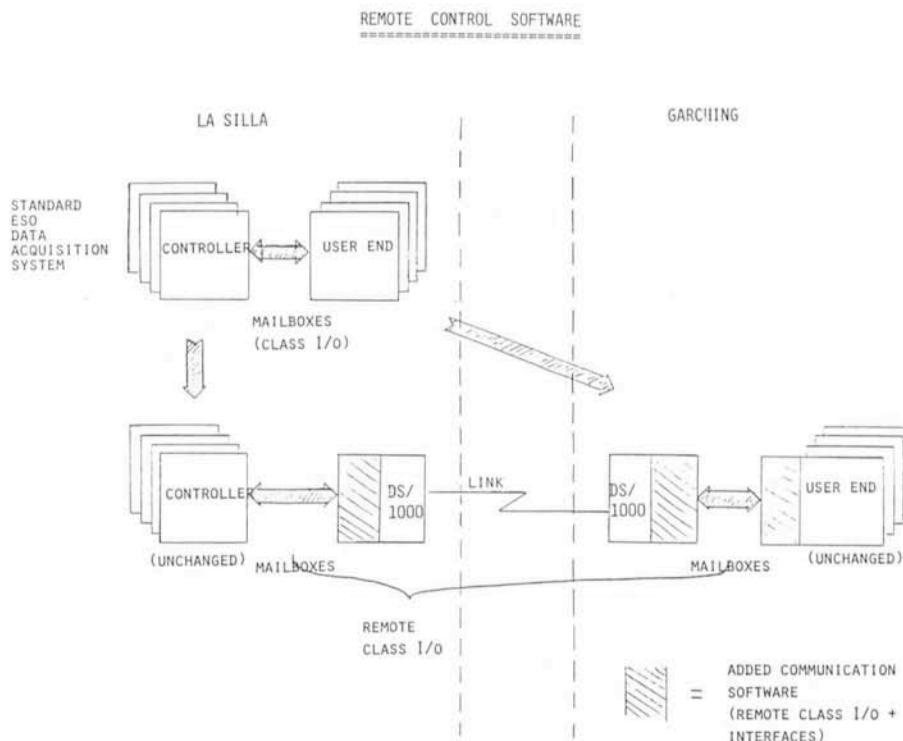


Figure 3: The control/acquisition software, as implemented in ESO, was adapted to remote control with the insertion of a remote mailbox package.

– About global reliability one should say that very few restarts of the control software environment were ever needed. Once computers had been started properly at the beginning of the night, they would go on with less than one restart per night. Even short accidental interruptions of the line, by using the telephone when data transmission was going on, were recovered.

– The manual switching procedure among telephone, Telex and computer mode demanded for a precise operating discipline, which would not be needed if a way were found to have everything, including switching, under computer control.

– More shall be done and can easily be implemented in the direction of automatic data transmission, after every exposure, on the basis of computer procedures.

– During the day-time, the link was used for telephone communication between La Silla and Garching. A permanent open line between these two ESO sites is important to further improve communication and collaboration.

– Any kind of files and data can be transferred at day time. A significant example was the transmission of Halley images coming from the Wide Field CCD Camera telescope, transferred to Garching in the morning following the La Silla observation within a matter of minutes.

– The large amount of data involved plus the additional advantages just

mentioned for day-time use of the line make a leased line a preferable solution with respect to packet switching from an economic point of view. Reliability,

reduced delays and all-time availability of a leased line are additional bonuses. However, packet switching communication will also be tried with La Silla during pending RC tests. This could become a general-purpose tool for exchanging messages and short files.

– The 2.2-m telescope was taken as a test case, but also other telescopes and instruments at La Silla could in principle be operated under RC.

## Conclusions

We feel that the test was quite successful in showing the potential of "Interactive Remote Control". Astronomers have been working quite efficiently, not too far from what they could do by being physically at La Silla. The efficiency could easily be further improved by simple measures and procedures in the software.

The approach of using a leased line seems correct; though the case for a wider bandwidth is still open, particularly in view of larger size CCDs and in order to allow more parallelism for voice and video information. Also from the point of view of cost, the large amount of data transferred and the use of the line for telephone communication during day time, seem to justify the use of a leased line.

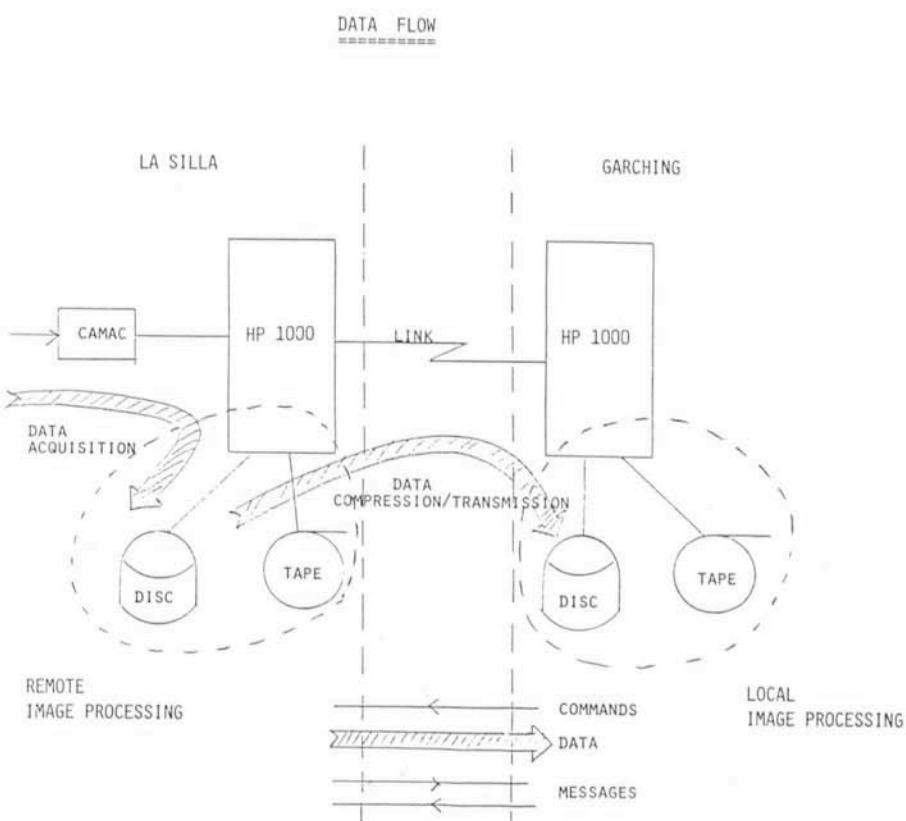


Figure 4: The digital communication flow of information both for commands and data. The control, acquisition and transmission of data was all under remote control commands sent from Garching.

It is also clear that interactive remote observing, in the way it was tested, offers entirely new working conditions to astronomers. Flexible scheduling, a few hours work on a telescope, recovery of lost nights at La Silla are all concepts which find a solution under remote control from Garching.

The test run also provided us with a lot of feedback in terms of desirable improvements which should be made in order to have a friendly-and-easy-to-

use permanent remote control facility in Garching. We now feel confident that future implementations of RC, like in the case of the NTT, can be based on experience and are technically understood.

The net price of RC features, when cost of operations in Garching versus costs at La Silla are taken into account, seems to be reasonable. RC from Garching becomes therefore an open option, even for the near future.

#### Acknowledgements

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## Computer Aided Design of Printed Circuit Boards at ESO

H. KASTEN, ESO

Whenever a new ESO instrument is made available to visitors, they receive a well functioning device which has been tested over and over again. The astronomer of course expects this, and when he sits in front of the computer terminal, happily monitoring this or that celestial object, he is unlikely to think of the amount of work that has been performed before. He is rarely aware of the densely packed electronics racks in the other room and even less of the rows and rows of "cards" within them.

ESO designs its own instruments because it would be very difficult, if not impossible, to contract this work to outside firms. However, after the initial design phase, industries in the member countries are often asked to build parts according to the detailed plans produced at ESO. This is also the case for some electronic components. In order to accommodate modern electronics and to facilitate maintenance, it has since long been customary to design Printed Circuit Boards which can easily be plugged into the cabinets. The design of such boards (PCB) was always rather difficult and time-consuming, but a new computer-supported technique (CAD = Computer Aided Design) has now for some time greatly facilitated this kind of work at the Electronics Group at ESO.

The new system increases the reliability and precision and significantly reduces the time needed to design a board. It is based on a Prime Computer 2250 and two software packages, Autoplan and Autoboard. The CV-Grado system was installed in early 1984 and has since been used extensively. The production rate is now several dozen of new boards/year, each having up to 300 electronic components. The starting point is a "messy" circuit diagram and the result is a well organized, (near)-optimal configuration of the PCB, with all wiring, etc. specified.

The operator starts by inputting the connection list, i.e. which components shall be connected with each other at which points. The programme then

places the components within the board perimeter. This can be done automatically or interactively to obtain the best possible component-to-board area



Figure 1: The CAD-PCB system at the ESO Electronics Group in Garching.