

AT/ No.1

AT.39.3/021

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## Remote and Unattended Observing at Narrabri

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May 19, 1992

### Introduction

At the present time the only observing mode supported at Narrabri requires an observer to be in full-time attendance: on the premises within call of a terminal. This mode was obviously necessary during the commissioning phase of the array, since uncorrected hardware and software failures could compromise the safety of the antennas and the quality of the observations.

With the recent hardware and software upgrades the reliability has improved to the point where we can now contemplate alternative observing modes.

- Remote Observing would allow an astronomer to control and monitor the observations from a remote site, requiring only an adequate computer link.
- Unattended Observing would allow a "batch mode" with an observing schedule being submitted to the Narrabri computer, and with the observation run with no human supervision.

The purpose of this note is to explore the problems which remain before we could offer these alternatives.

### Hardware safety

Much effort has been expended to make the hardware self-reliant and self-protecting. Even now the operator is a minor player in ensuring the safety of the equipment;

- Antenna motion is safeguarded by limit switches; by specific hardware in the SWEO electronics; by fuses; by software limits in the ACC and in the observing task (CAOBS).
  - Power systems failure (mains, generator, UPS) at one or more antennas will cause an alarm.
  - The weather station and the stormscope will stow the antenna if bad weather seems imminent.
  - Failures in the cryogenics are trapped in hardware, and signalled by the monitoring systems.
  - High temperatures in the vertex room are signalled by the monitor system.
  - Smoke and fire detectors are distributed throughout the system.
- All Primary Monitor and fire alarms are distributed site-wide (to on-call person, then to all residents).

This suggests that the need for an on-site observer is slight, provided these safety features are inspected at regular intervals. Probably the worst case scenario is when the antennas are at low elevation, the power has failed, and strong winds are in the offing. Since an alarm will be triggered if the antennas have attempted unsuccessfully to stow, this contingency is covered to a reasonable extent.

I would argue therefore that the present safety system is adequate for these alternative observing modes. I would also argue that they must be made sufficient, else we will never be able to operate MOPRA satisfactorily. Further, I believe that the standards established overseas indicate that this goal is achievable.

## Data quality

Problems persist at the present time which argue against Unattended Observing: for example, Antenna #2 occasionally fails to track; correlator blocks 12 and 18 need to be reset. These can be diagnosed remotely, but require an on-site person to remedy the problem. This suggests that in the short-term remote observing is possible only if the remote observer can contact an on-site person - duty astronomer?

## Requirements

### Remote Observing:

A dedicated computer link allowing the observer to run simultaneously CAOBS, CACOR, CAVIS, ASSISTANCE.

The link requirements are modest - 9600 baud would probably suffice, but more would be preferable. (There is some local disagreement on whether 9600 is adequate). It might be wise to wait for the ISDN link.

A watchdog could be placed on the link to stow the antennas if the link were to fail.

### Software Modifications:

CAOBS at present has a simple security trap which encourages the use of a specific terminal. Users knowing the relevant key can however run CAOBS from any terminal. This facility would need to be strengthened - either by a stricter use of a password, or by specific granting of the resources by the system manager.

CACOR would need to get the display task (COR\_DISP) to load the default display visibilities in order that DELCOR, ASSISTANCE and CAVIS can operate.

ASSISTANCE might enlarge its checks - to maintain an eye on the weather and LO tasks.

### Hardware modifications:

The current problems (Antenna #2; correlator blocks) need to be resolved (required in any case). I don't think that there are any other

The main residual problem is the integrity of the power systems. The control building does not have a diesel generator - power losses lasting longer than 15 minutes cause big trouble. Critical LO and timekeeping systems are being backed up separately, with the PMon and some workstations already backed up.

The antenna power systems are still flakey. Genset start problems will be alleviated with new battery chargers and new policy of replacing starter batteries each year. However, we can still count on some level of "fail to start" problems.

With Sweos running on council mains, we will still have occasional drive latch-ups. We could replace all the UPSs with 3-phase units. More pragmatically, we could make much greater use of the diesel generators during suspicious weather conditions.

## Implementation

I see no compelling reason why REMOTE could not be offered immediately, during office hours. After-hours observations might require further negotiations with the duty astronomer.

Full REMOTE observing should be possible when the ISDN link is closed.

Unattended Observing should wait until experience with the system has demonstrated the suitable level

of reliability .. I think Jan. 93 should be a reasonable target.

## Why offer these alternatives?

This section is probably superfluous. However:

### PRO:

- It would make better use of astronomer's time, by cutting down on travel time .
- It would reduce the travel budget.
- Unattended observing might even improve reliability: a non-trivial fraction of the problems have arisen from finger troubles, and the universal need to "adjust".

### CON:

- The observatory would miss out on the friendship and science of the visitors.
- Data quality might suffer in the early days.

(PJE) My biggest worry is the lack of interaction with observers. It makes the final product even more invisible to people at the Observatory. One could become a trained monkey who does little more than fight fires started over a phone line!

I see the approach which includes a duty astronomer + 1 or 2 operators as also being viable. The high tech approach is more elegant and attractive (to me at least) but I wouldn't dismiss the operator option at this stage - I think it could also be made to work. Of course, the interaction problem is just as bad.