Hi-tech weather watchers on world stage

ATRAD, an Adelaide University spin-off company, has recently signed three contracts worth more than two million dollars that will place Australian meteorological expertise on the world stage.

Few sciences have become as complex as meteorology, or developed so fast from such humble beginnings.

Illiterate sailors once learned basic rhymes to help them remember what weather might follow certain cloud formations: 'Red sky at night sailors' delight, red sky at morning, sailors' warning' was almost as elaborate as it got. 'Mackerel skies and mare's tails, wise sailors furl their sails,' told of storms that were likely to follow high cirrus clouds but at that time even the term 'cirrus' would not have been recognised, for clouds had not yet been classified.

Today, meteorological equipment embraces ocean buoys and satellites, Antarctic stations and more.

One of the newer technologies is radar. Developed in World War II to detect incoming aircraft, it can now be used in the lower atmosphere to detect changes in humidity and temperature.

"These changes appear as 'targets' which move with the background wind, and effectively trace its path," said Dr Iain Reid, Associate Dean for Commercialisation in Adelaide University's Faculty of Science.

"By measuring the movement of these targets, wind speed and direction can be determined," he said.

Dr Reid, from the Department of Physics & Mathematical Physics, is a member of the team which has developed the technology, and he is now a Director of Atrad.

"Turbulence also produces changes in temperature and humidity," said Dr Reid, "and radar can measure the strength and location of this turbulence as well. Depending on the power and frequency of the radar used, information about wind speed, direction and turbulence can be obtained from the ground up to about 100 kilometres."

At about half that height, the sun ionises the atmosphere, separating electrons from their host atoms. Radar can also detect these electrons, and use them as tracers of atmospheric movements.

Meteorological radar is generally used in weather watchingæscanning horizontally to detect precipitation such as rain or snow over a large region. The kind developed at Adelaide University produces a vertical profile of the wind directly above the radar, information that has traditionally been gathered by instruments launched on balloons as often as four times each day. The information is then fed into numerical computer models and used to predict weather patterns.

Atrad has commercialised several types of radar developed by the department's Atmospheric Physics Group.

"Atrad has been providing various kinds of radars for years. It is a science-driven company, and its reputation has grown steadily," said Dr Reid.

The Japanese Aeronautical Laboratory is acquiring one radar from Adelaide to be used in flight trials of a model supersonic transport aircraft at Woomera. The radar will measure the vertical wind to determine the most suitable launch time. Later, it will help to verify the plane's flight performance.

Mr Rob Silva, CEO Atrad and Dr Iain Reid with a computer image of the radar power returned from the atmosphere. Photo: Rob Morrison.

Atrad will also supply a very powerful VHF radar to Wuhan University in China. Ranked among the world's top facilities in terms of capability, it will assist research of a similar calibre.

"China is investing in science and technology in an attempt to bring themselves up to world standards in several areas," said Dr Reid.

"There are perhaps only three other radars in the world with comparable ability."

Another of the company's radars is destined for weather forecasting in the UK meteorological office. It will replace a balloon station in northern Scotland, where severe weather frequently tracks over the UK and into mainland Europe.

—Rob Morrison

Pokie problems focus of radio series

PROBLEM gambling will be the focus of a 10-part series to be broadcast on 5UV Radio Adelaide from 10-21 September.

Presented by Tony Ryan, *Pokies, Blackjack and All That* will explore some of the personal and social issues associated with gambling. It will include stories of the pain suffered by many gamblers and their families as well as helpful strategies for people trying to cope with the problem.

Each 6-7 minute program will be broadcast daily on Radio Expresso at 7.35am and repeated on High Noon at 12.35pm. The programs will also be broadcast on many of South Australia's 18 community radio stations and will be available on the Internet. Funding for the series was provided through the Gamblers Rehabilitation Fund, a joint initiative of the Australian Hotels Association (SA Branch), Clubs SA, and the State Government (through the Department of Human Services).

The series is part of 5UV Radio Adelaide's lifelong learning strategy, which aims to complement the station's mix of news, arts, current affairs and cultural output with education-based programs. Other lifelong learning initiatives to be broadcast soon are The Learning Connection (a five-program series exploring lifelong learning in South Australia, starting 3 September); *Aspects of Ageing* (15-part series on ageing, starting 24 September); and *Wetlands Drylands* (30-part series on the River Murray, starting 15 October).

"There are strong links between community education and lifelong learning and what community radio is able to offer," says Tony Ryan, the station's Executive Producer, Lifelong Learning. "These links are well worth pursuing and that is what our strategy aims to do."

Full program details can be found at: http://www.adelaide.edu.au/5UV/

New tissue-imaging facility

ZOOLOGISTS, anatomists, physiologists and more have all faced the same research dilemma. Investigation can destroy what is being examined, or change it so much that it is no longer the thing that they want to examine.

Microscopy has been one of the most powerful tools in modern science; the scientist seated at a microscope is a symbol of modern research, but even microscopy takes a toll of its subjects.

Traditionally, tissues have been killed, then frozen or embedded in blocks of paraffin, and sliced much thinner than paper for microscopic inspection. Such treatment was necessary to allow light to pass through the tissue to reveal its cellular details, as it does through a stained glass window. Electron microscopy can be even more severe.

A new multi-photon microscope at the Waite Campus offers South Australian researchers a new, non-invasive way to examine living tissue and intact cells without having to destroy them.

"The multi-photon microscope differs from this sort of microscope because it allows you to produce images inside intact cells without having to destroy the cells themselves," said Dr Meredith Wallwork, Manager of the Confocal Facility at the Waite Campus, where the new microscope will be located.

The multi-photon microscope is a very specialised fluorescence microscope, comprising a laser and conventional fluorescence microscope all operated by computer. The laser produces rapid pulses of long wavelength red light, creating images of biological material by showing up those structures inside cells that fluoresce under light.

This fluorescence may be inherent in the material itself, due to its chemical composition, or the material may be stained with one or more fluorescent dyes to show up particular structures or compounds.

The fluorescent images give information about particular structures inside living cells, or of reactions going on within the cells, without damaging or killing them.

"There is evidence that living cells can be observed with the multi-photon microscope for hours, as opposed to minutes, as is the case with more conventional fluorescence microscopy," said Dr Wallwork.

"In simple terms, the multi-photon can be thought of as a CAT scanner for cells. It is designed to generate a series of optical sections through a bulky sample and then with powerful computer processing, to reconstruct these sections into a complete 3D image of the sample."

"Exposure of the whole sample to the laser beam is reduced in this microscope, so there is less loss of fluorescence as well as less likelihood of photobleaching, and therefore damage to the sample," said Dr Wallwork. "Clear images are visible to greater depths."

The multi-photon microscope was purchased through a successful ARC grant application made by Adelaide University, Flinders University, University of South Australia, CSIRO and Institute of Medical and Veterinary Sciences in cooperation.

It is used by researchers from all these organisations, and has a wide range of applications in examining diverse plant and animal tissue, from individual cell cultures to intact tissues such as embryos.

"There are likely to be some very useful applications for research and development organisations in the private sector as well, especially in new technology areas," said Dr Wallwork.

"It will help researchers in South Australia, and assist cooperation between our collaborators," she said. "We are encouraging people to make use of this new and exciting technology for basic research."

The new microscope was officially opened last month by Professor Edwina Cornish, Deputy Vice-Chancellor (Research) at Adelaide University.

—Rob Morrison