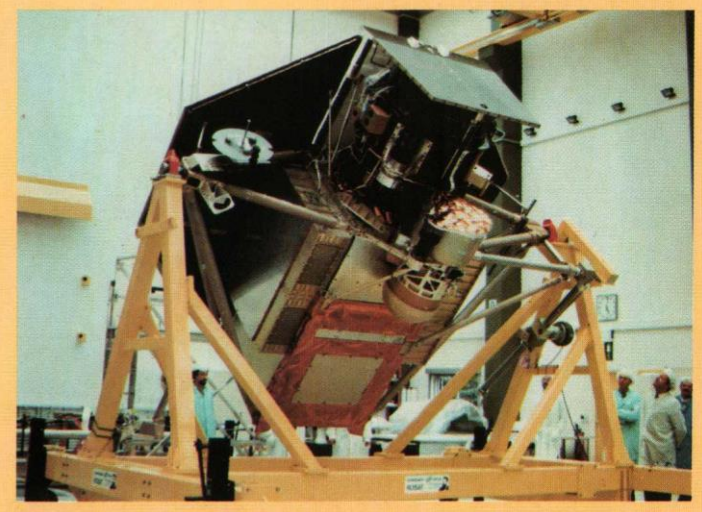
In Search of Tomorrow

at
Rutherford
Appleton
Laboratory

RAL is the largest of the Science and Engineering Research Council's research establishments. It provides a wide range of experimental and support facilities to scientists and engineers working in the UK and abroad.

SPACE



The Wide Field Camera mounted on ROSAT

The advent of space flight opened new windows on the Universe. No longer are astronomers confined to ground-based observations. From above the obscuring blanket of the Earth's atmosphere space probes are providing new and exciting information on distant objects invisible to optical and even radio telescopes.

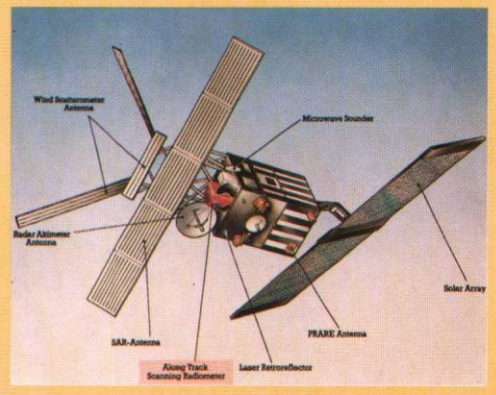
Rutherford Appleton Laboratory has provided instruments and monitoring for many international space experiments over the past 20 years, Giotto, IRAS, AMPTE, and the NASA Spacelab Solar Maximum Mission being some of the most well known.

RAL's current projects include a joint German/UK/US space experiment, Roentgensatellit (ROSAT). With five other UK groups RAL is constructing an extreme-ultraviolet wide field camera to be launched on ROSAT. This camera will conduct the first survey of the complete sky at wavelengths between 60 and 300 angstroms. The large sky coverage of ROSAT and its high sensitivity promise exciting astronomical discoveries.

Looking Earthwards from space is proving no less exciting. The study of the Earth's surface offers immediate practical benefits to many areas of everyday life – climate, communications, meteorology, land management, mineral exploration etc.

ATSR (Along Track Scanning Radiometer) is an infrared detector designed to measure sea-surface temperatures from space with the high degree of accuracy required to model the behaviour of the global climate. RAL together with other groups from the UK, from France and from Australia is preparing this experiment to fly on ERS-1 the European Space Agency's first Remote Sensing Satellite.

ERS-1 showing position of ATSR

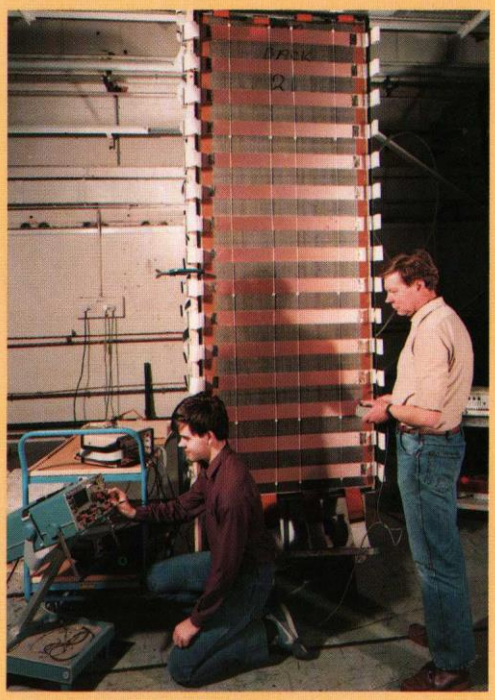


PARTICLE PHYSICS

In recent years, particle physics has developed as a separate branch of nuclear physics, particularly following the discovery of the constituents of protons and neutrons in the late 1960s. These constituents, called quarks, together with leptons (the electron and its heavier relatives), build the world we know.

To study these incredibly small particles, beams of particles such as protons or electrons are accelerated to enormous energies and brought together in head on collisions. Very large and complex detection apparatus is then needed to study the products of the collisions and deduce the properties of the quarks.

One of the activities at RAL is the construction of such detectors. This places enormous demands on the design ingenuity of the scientific and engineering staff. The apparatus needs to be large (often thousands of tonnes) in order to absorb the high energy particles, it needs to have high resolution (tens to hundreds of microns) to measure the position and energy of the particles and it needs to possess a large number of high speed data output channels. In addition to these often conflicting requirements, the apparatus needs to be extremely reliable since it can be largely inaccessible for periods of a few years at a time and maintenance is difficult if not impossible.

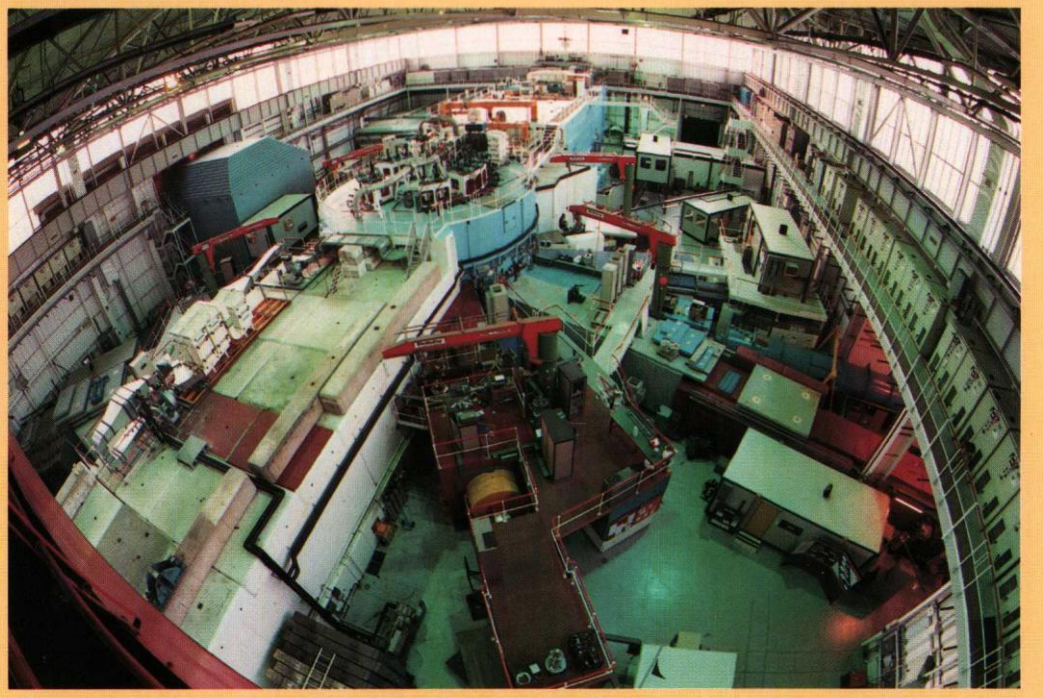


Assembling a module for the Soudan II proton-decay experiment

Superconducting solenoid built at RAL for the Delphi experiment

A typical detector measures the curvature of a charged particle as it traverses a magnetic field and the design of the apparatus requires a high field over a large volume. The technical solution can only be realised by superconducting magnets. One such magnet, 6 metres long and 6 metres in diameter, producing a field of 1.2 tesla, has been built recently at RAL for installation in the Delphi experiment at CERN, Geneva, and a second one is now nearing completion.

NEUTRON SCATTERING



The ISIS experiment hall

ISIS is the world's most intense pulsed source of neutrons. Measurements are carried out with a previously unachieved precision and this has had a major impact on research into the microscopic behaviour of solids and liquids. Neutron experiments provide information on atomic and molecular arrangements and also on the dynamic and magnetic properties of systems of interest to many branches of science and technology. The neutron is an ideal particle for this type of work because it has no electric charge and interacts with matter in a very simple way.

A handful of examples show the uniqueness of ISIS and its usefulness in both pure and applied fields:

– Detailed diffraction studies of high-temperature superconductors have shown previously unresolved subtle structural variations which have significant implications for the electronic and superconducting properties of these materials.

– Surface studies, using a state-of-the-art reflectometer, are answering many questions posed by industry concerning topics such as the stability of liquid layers, vital to detergent chemists, and the magnetic structure of surfaces, of interest to the semiconductor world.

– Spectroscopic measurements are yielding new information ranging from the motion of small molecules in solids to magnetic excitations in metals and quantum effects in liquids.

COMPUTING

RAL's Atlas Centre provides large-scale computing facilities for SERC-supported researchers throughout the UK and is the home of the Joint Research Councils Supercomputer Unit.

Scientists from all disciplines use the Centre's facilities. High energy physicists analyse vast amounts of data and own most of the 60,000 magnetic tapes stored at Atlas. Theoretical chemists carry out huge computations using the Cray supercomputer which is capable of processing one thousand million arithmetic operations per second. Astronomers around the country process satellite data which has been stored using sophisticated database techniques. Microelectronics engineers use the advanced colour graphics facilities for visualising chip designs. In addition, about 500 SERC managers, administrators and scientists use the Centre's office automation system to handle mail, prepare documents, manage their diaries and schedule meetings.

All these users are linked by JANET, the joint academic network managed from RAL, which reaches into every UK university and many polytechnics and research establishments.

The Cray X-MP/48

Computing is an essential component of modern scientific research and in addition to the facilities provided by the Atlas Centre, RAL uses computers in many other ways.

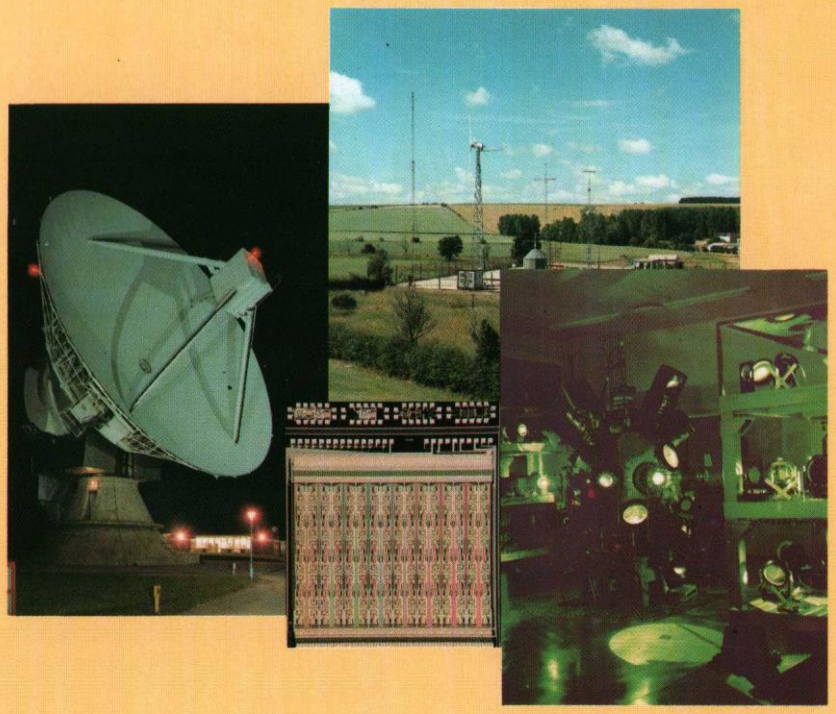
RAL has a major involvement in research programmes involving the use of novel computer architectures and software; it coordinates the SERC/DTI programme on the Engineering Applications of Transputers.

All the major experimental facilities at RAL – ISIS, the Laser facility, Electron Beam Lithography – involve the use of computer systems for the control of equipment and the capture of experimental data. These range from purpose built micro systems to networks of large minicomputers.

Versatec plotter

RAL also has an exciting research programme in the fields of laser research, climatology, radio propagation, image processing, microelectronics, superconductivity, medical applications, wind energy, and electron beam lithography.

Guided tours can be arranged for groups of not more than 30 persons (all visitors must be over the age of 15).



For details please contact:

Press and Public Relations
Rutherford Appleton Laboratory
Chilton
DIDCOT
Oxfordshire
OX11 0QX

Tel: Abingdon (0235) 21900 ext 5553