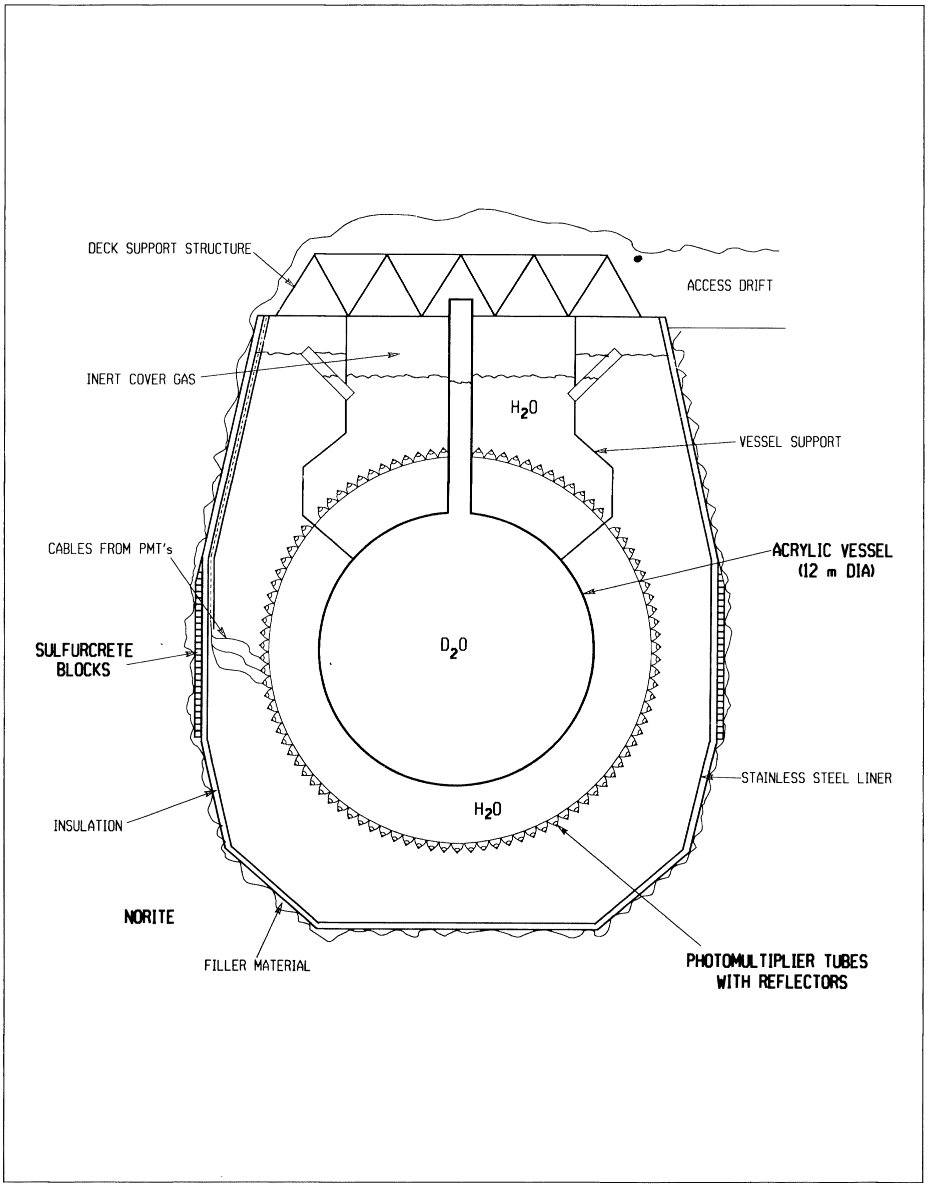
Design for the new Sudbury Neutrino Observatory to be built 2000 metres underground in a Canadian nickel mine, showing the inner heavy water target vessel surrounded by the ordinary water vessel and banks of photomultipliers.



tive of the US Department of Energy reviewed the DOE seed-money programme for attracting industry into this field.

The workshop should become an annual event.

NEUTRINOS
Heavy water detector

The proponents of the Sudbury Neutrino Observatory (SNO) received a welcome Christmas present when William Winegard, Canadian Minister for Science and Technology announced the final details of the funding for this project, totalling 48 million Canadian dollars and including contributions from the US and the UK.

The SNO experiment will extend significantly the study of solar neutrinos, using some 1,000 tonnes of heavy water to be installed more than two kilometres below ground in a nickel mine at Sudbury, ntario.

Until recently, the only detector homing in on neutrinos from the sun was the 600-tonne tank of chlorine-rich dry cleaning fluid used by Ray Davis' team in the Homestake mine in South Dakota.

Picking up solar neutrinos through induced transformations of chlorine nuclei into argon, the detector does not see the level predicted by confident calculations of solar neutrino processes. In a scenario of modern physics which otherwise looks very neat, this 'solar neutrino puzzle' needs to be explained.

Recently the Japanese Kamioka underground experiment, using specially developed 20-inch photomultipliers to pick up Cherenkov radiation from neutrino-electron scattering in a 2000-tonne water target, has begun to provide an alternative source of solar neutrino information. Sensitive to all kinds of neutrinos, (the chlorine transformations in the Homestake mine experiment are triggered by only electron-type neutrinos) and in addition giving directional information, Kamioka nevertheless confirms the result of the pioneer experiment.

As well as scattering off electrons (as in the Kamioka study) to give information on the neutrino flux, electron neutrinos encountering the Canadian heavy water target could also transform the nuclear deuterons into proton pairs, releasing an electron. This particle would carry off most of the neutrino energy and would provide valuable spectral information.

However neutrinos (of all types) hitting a deuteron could also break it up into a proton and a neutron. This reaction will be monitored by detecting the results of the energetic gamma rays following the capture of the released neutron.

Thus the Sudbury scheme will provide important additional neutrino information. Sensitive to all neutrino types, it will probe the possibility of neutrino 'oscillations' – under certain conditions, neutrino types may not be immutable, but may switch back and forth, providing an alternative scenario, if not an explanation, for the solar neutrino problem.

Oscillations would show up by comparing the flux of electron- and other types of neutrino. If, as has been suggested, these neutrino transitions occur deep inside the sun, this would be reflected in the shape of the spectrum.

The Sudbury underground detector is expected to pick up about 10,000 neutrino interactions per year, with the resulting light flashes recorded by an array of 2,000 large photomultiplier tubes. Construction and installation will take about five years.

In the Italian Gran Sasso underground Laboratory (May 1987, page 26), other new detectors using sophisticated materials and detection techniques are being prepared to provide additional new insights into the nuclear mechanics of the sun's interior.

LISBON Supercomputer for Portugal financed from 'CERN Fund'

A powerful new computer is now in use at the Portuguese National Foundation for Scientific Computation (FCCN Lisbon), set up in 1987 to help fund university computing, to anticipate future requirements and to provide a fast computer at the National Civil Engineering Laboratory (LNEC) as a central node for remote access by major research institutes.

Taking into account especially the requirements of Portuguese physicists involved in research at CERN, a specification was drawn up for a 10 Mflop, 32 Mbyte scientific machine operating under UNIX. After proposals from most major computer manufacturers, a solution based on a Convex C220 supercomputer was selected, and passed its acceptance tests at the end of September.

As well as high energy physics, the machine will also cater for computational mechanics and molecular chemistry, and serves as the central node of the Network for the National Scientific Community (RCCN), using both dedicated and public lines.

After Portugal became CERN's fourteenth Member State in 1985, the country's annual contributions to the Organization's budget increase gradually over ten years to the full amount specified by CERN's Convention. During this time, the difference between the actual and full contribution levels is earmarked (the Portuguese 'CERN Fund') for the development of particle physics in Portugal, so that the country's physicists can make full use of the Laboratory's resources, and for projects where Portuguese researchers on other areas (electronic welding, fast electronics, geodesy,....) can benefit from CERN know-how. Most of the money for the new supercomputer came from this Fund, where it was first mooted by the Fund's Scientific Committee in 1986.

The Committee, with a balanced membership from CERN and Portugal, and with a tradition of public presentations, has been a driving force in the administration of the Fund.