- Study how to educate users and potential users of microelectronics, particularly in relation to maintaining employment.
- Help develop new programs and languages appropriate to a personal computer (Servan-Schreiber version).
- Propose the means of transferring the technology to the Third World.

Robert Walgate

Magnetospheric experiment

UK joins in

The Science and Engineering Research Council has decided to fund participation by the United Kingdom, to the tune of £2 million, in the Active Magnetospheric Particle Tracer Explorers project (AMPTE). The council's Rutherford Appleton Laboratory, in partnership with the Mullard Space Science Laboratory of University College London and other university groups, will be developing the satellite as a separate component of the Ion Release Module satellite being developed by the Max Planck Institutes of

Astrophysics and Aeronomy in West Germany. The two satellites, together with the Charge Composition Explorer satellite being developed in the United States, will all be launched in mid-1984 on a Thor Delta rocket, hastily acquired following space shuttle delays.

The magnetosphere is the region where the magnetic field of the Earth interacts with the charged particles and magnetic fields of the solar wind, the continuous flow of plasma from the Sun. The aims of the experiment are to release lithium and barium ions into the Earth's magnetosphere and, by monitoring their subsequent behaviour, to investigate several fundamental aspects of the magnetosphere as well as to simulate conditions near other planets. The Ion Release Module will be placed in a highly eccentric orbit, so that ions may be released both inside and outside the magnetosphere.

One of the problems to be tackled by the Charge Composition Explorer is to determine whether or not the magnetosphere is "open" — that is, whether the Earth's magnetic field lines can connect with those of the interplanetary medium so that solar plasma can enter the Earth's field

from downwind. To this end, ions will be released just upstream of the bow-shock. The Charge Composition Explorer, in an equatorial orbit, will detect those ions only if the magnetosphere is "open".

The UK satellite will be placed in an orbit with that of the release module, maintaining a separation of 100 km or so. The particle and field detectors on board will monitor the behaviour of the ejected ions immediately after release. Lithium ions, being light, should pick up a large component of the velocity of the solar wind unless disturbed by plasma instabilities.

The release of the barium ions should produce rather more spectacular results. Because they are more massive than most components of the solar wind, the surrounding plasma will be impeded and a glowing comet-like structure will be produced. If the barium ions are released within the high-velocity plasma of the magnetosheath near dawn or dusk, the cloud will be visible from the ground, and will simulate conditions to be found in comets and in the magnetosphere of Venus. When released "downwind" in the magnetotail, where plasma flows more slowly, conditions will be more similar to those near Io and Titan within the magnetospheres of their respective planets Jupiter and Saturn.

Philip Campbell

NASA budget

Small is necessary

Washington

As the National Aeronautics and Space Administration (NASA) locks horns with the Reagan Administration over just how large a budget cut it must face next year, US space scientists are trying to devise a strategy for exploring the Solar System within the tight budget constraints likely to dominate for the next few years.

For the fiscal year beginning 1 October 1982, the Office of Management and Budget (OMB) has told NASA to prepare for cuts of about \$1,000 million in a budget previously projected at about \$7,000 million. Agency officials are strongly resisting this request, arguing that such a cut would severely damage all NASA's programmes; they have already gone over OMB's head to the White House in an attempt to get the proposed cuts reduced before the budget is formally submitted to Congress in January.

However, the prospects for NASA in general — and space science in particular — are likely to be bleak for the next few years. In this context, the agency has set up a Solar System Exploration Committee to take a close look at the type of projects it should be planning for the future. "If something disastrous were to occur to NASA's budget next year, it would be even more important to plan how we should recover", Dr Noel Hinners, the committee's chairman and director of the National Air and Space Museum in

Washington said last week.

The main aim of the committee is to increase the efficiency of planetary and other Solar System missions while reducing the costs, in particular by breaking down the scientific goals of the missions into "smaller bites" than those represented by, for example, Voyager.

One way of achieving this goal would be to build directly on the experience of previous missions. For example, the Ames Research Laboratory is looking at ways of developing Pioneer-type orbiters to some of the inner planets, using derivatives of terrestrial orbiters to study the geological characteristics of the Moon or Mars.

Pioneer-type spacecraft would only be able to achieve relatively limited scientific objectives, and would produce a relatively low data rate. But a mission could be launched for between \$100 and \$150 million, the same order of magnitude as the Explorer satellites currently being successfully used by NASA.

As well as looking at ways of using smaller spacecraft, the committee is investigating how to save money by increasing operations efficiency, for example by reducing the length of trips, compressing the scientific data to be transmitted back to Earth or the sharing of individual pieces of equipment between different research groups.

Four subcommittees will meet next month at the Jet Propulsion Laboratory to work out the type of programme that could be developed on the basis of such components. The subcommittees expect to report to NASA with specific mission proposals by next summer.

Dr Hinners said last week that he had discussed this new approach in some detail with officials at OMB, who expressed general approval but raised two possible objections. First that a list of the various missions which could be included in an overall envelope of between \$300 and \$400 million a year — only slightly above the current level — looked like an ambitious shopping list; and second, that breaking down planetary missions into smaller projects might lack the public appeal of Apollo or Voyager.

To the first objection, NASA replies that it is the size of the effort and the balance between costs and return that should be measured rather than the number of space vehicles flown. The second objection raises a broader question faced by NASA: can the apparently-increasing enthusiasm among the public for space exploration, particularly in the light of the excitement generated by photographs sent back by the Voyager spacecraft, be interpreted as a mandate to increase spending on space science?

Those who do believe that the public will be eager to support ambitious plans for space exploration are still pushing hard for what they consider should be the next major mission, a manned sample-return space vehicle to Mars. NASA administrator James Beggs told the advisory

board last week that he shared the enthusiasm for such a project, although arguing that it should be planned in conjunction with what is likely to be NASA's next major project, a permanent orbiting space station which could be used as a base for manned planetary missions.

Members of the advisory board wondered whether there might be a danger that if NASA did embark on such a project it might further squeeze the space science budget, as the Apollo Moon landings and the space shuttle appeared to have done, but Dr Beggs tried to calm such fears. Admitting that the near-term looked relatively bleak, with no new planetary starts likely to be approved for 1983 or 1984, he replied that in the past the space science budget had done best precisely at those times when NASA had been able to generate political support for its major undertakings.

David Dickson

Diablo Canyon reactor Licence revoked

Washington

The US nuclear industry has come in for an unexpected roasting from the new chairman of the Nuclear Regulatory Commission (NRC), Dr Nunzio Palladino. His criticism of its quality control was made before a congressional committee on the same day that the NRC voted to revoke a licence issued only two months ago to permit start-up tests at the Diablo Canyon nuclear reactor in California, on the basis of a series of engineering mistakes made when the plant was strengthened to resist earthquakes in the mid-1970s.

Six weeks of frequently-violent demonstrations by anti-nuclear protesters in September and October failed to stop the plant's owners, Pacific Gas and Electric

Company, from proceeding with plans to start to load the reactor with uranium. The protesters claim that the plant is inherently unsafe because it has been built less than three miles from the Hosgri Fault, a branch of the San Andreas Fault system.

As the demonstrations were coming to an end, however, an engineer with the company discovered that a blueprint had been misread when the plant's support structure was being strengthened to compensate for the possibility of earthquake damage, causing the loads on various components to be miscalculated. Further errors found later included the misapplication of stress level numbers along the Hosgri Fault and the use of incorrect data in calculating the ability of pipes to withstand an earthquake.

Besides causing considerable embarrassment to the Pacific Gas and Electric Company, this discovery led to immediate pressure on NRC from Congress. The Reagan Administration has promised to speed up the licensing of new plants; but this strategy requires that public confidence should be maintained that safety is not being sacrificed in the process.

Appearing before the House Interior subcommittee, Dr Palladino, former dean of engineering at Pennsylvania State University, said that "after reviewing both industry and NRC past performance in quality assurance, I readily acknowledge that neither have been as effective as they should have been in view of the relatively large number of construction-related deficiencies that have come to light".

An order approved by the five-man commission, which voted 4-1 to suspend the low-power operating licence and unanimously for an independent audit of the quality control safeguards used by Pacific Gas and Electric Company, said that the suspension was necessitated by the seriousness of the errors in the initial review of safety modifications.

Following NRC's decision, the Pacific Gas and Electric Company issued a statement saying that it was "disappointed", since "nothing has been discovered to date that would indicate that the plant is not safe". The company claims that the plant had many redundant safety systems compensate for any threat from the Hosgri Fault.

David Dickson

More bickering about solar satellites

Washington

The National Aeronautics and Space Administration (NASA) seems unlikely to grant the request from the European Space Agency (ESA) to bring forward the launch of the International Solar Polar Mission, now due in 1986.

ESA had made this request following NASA's decision to stop work on the vehicle which it was to have provided for a dual-spacecraft mission, with the original intention that the two would pass simultaneously in opposing orbits over the poles of the Sun. European scientists had hoped that NASA, which will still launch the ESA space vehicle from the space shuttle, would be able to arrange an earlier flight to help compensate for the disruption and the loss of experiments which the cancellation has caused.

Last week, however, NASA officials said that the growing concern over whether the shuttle will be able to maintain an already overcrowded launch schedule means that a 1984 launch is virtually out of the question.

There is a slight possibility of a launch in 1985. However, since there is only a relatively short launch window in that year, and since the same window is required by the Galileo probe and orbiter scheduled to start its journey to Jupiter at the same time, the chances of arranging both launches within the same period seem slim.

ESA officials are still angry at the way in which NASA cancelled its proposed spacecraft; a resolution adopted by ESA's space programme committee last month suggested that ways should be explored of seeking some type of compensation from the US agency and ESA's secretary general Dr Quistgaard suggested the early launch date as one form of recompense.

US officials admit that it is the first

time NASA has had to go back on a previous agreement, but claim that the "memorandum of understanding" signed between the two organizations makes it clear that the solar mission agreement was subject to the availability of funding, and that NASA could not legally commit itself to more than one year's advance funding.

In addition, Dr Hans Mark, deputy administrator of NASA, told a recent meeting at the National Academy of Sciences that although the decision to cancel NASA's involvement in the solar mission was regrettable, there had been several occasions in the past when European governments had broken commitments, for example some of those made through the North Atlantic Treaty Organization.

On the first point, ESA claims that the memorandum of understanding had been agreed on the basis that normal funding procedures would be pursued by both sides — and that NASA is at fault not for having failed to provide the funding promised, but for having decided unilaterally to omit the project from its request to the Office of Management and Budget for the 1983 budget. On the point that some European organizations have broken commitments in the past, ESA argues that it is not fair to penalize ESA for failures of individual European states.

Meanwhile NASA scientists are discussing the possibility of launching an Explorer satellite into an elliptic orbit around the Sun to coincide with the European spacecraft's encounter. This satellite, which would be launched in 1985, would provide baseline measurements of the solar wind — and that might go some way to making up for the deficiencies resulting from the decision not to send a full US spacecraft.

David Dickson

Uranium enrichment

US-India stand-off

New Delhi

India is trying to become self-sufficient in the production of fuel for its nuclear power plants following its bitter experience with the United States over the supply of low enriched uranium for the Tarapur plant in Maharashtra state.

The latest round of discussions between Indian and US officials has failed to break the impasse over the clearance of at least pending applications with the United