the satellites have produced a large yield of high quality information. In others, initial goals have proved to be over-optimistic. In particular, it has proved far more difficult than predicted to use satellites for assessing agricultural yields — for example because of problems in distinguishing between different types of crops — and more research is now being done in this area.

Enough information has been gained so far, however, to convince the US that remote sensing can provide useful information to developing countries in fields from water resource engineering (such as building dams or irrigation systems) to mineral prospecting. The US Agency for International Development (AID) has already carried out research projects and training in more than 30 countries, demonstrating how Landsat data can be used by local planners and policy-makers.

Speaking in Vienna last week after Father Hesburgh's address, Mr Tom Pickering, director of the State Department's Bureau of Oceans and the Environment, said that in announcing its new initiative, the US had two main goals, both of which were intended to help

developing countries make better use of remote sensing data.

The first goal is to bring together the various countries now planning their own satellite systems to ensure the maximum possible complementarity and compatibility. The aim, for example, would be to ensure not only the minimum of overlap and duplication, but also that wherever possible a developing country receiving station could use the same equipment for receiving data from different satellites.

The second goal is to bring together, possibly on a regional basis, those who intended to use satellite data to obtain information about their own resources, and how these might best be managed. "Our hope is that through discussion with users we can define together the sort of data that can be most effective in answering their needs, and in discovering about their own territories the type of things that they would like to discover," Mr Pickering said.

The Administration's decision was welcomed by Senator Adlai Stevenson Jr, chairman of the Senate's Science and Space Subcommittee, who has long been a critic of the current Administration's lack of plans for an operational Earth-monitoring

satellite system, advocating this as one of the most important areas in which US technology can help developing countries.

Describing the wide potential applications of remote sensing, Mr Stevenson said that the US "was concerned that these technologies will follow many national courses and that, if some cooperative steps are not taken soon, it may be too late to at least develop complementary technologies. By complementary we mean not only the physical systems, but also in their operation, so that satellites can be used in a way that avoid redundancies and maximises knowledge of the resources of the world."

Backing up the proposal made in Father Hesburgh's speech, AID mounted an exhibition in Vienna demonstrating the type of data that can be derived from Landsat and other satellites, and the way in which it might be used. The exhibition was to have been entitled "remote sensing: an appropriate technology for economic development" — until advocates in AID of a less capital-intensive approach to Third World needs objected, and the word "appropriate" was dropped from the title.

David Dickson

Interference with data from Titan

Vital data on the surface temperature of Saturn's giant moon Titan may have been lost as the result of radio interference during the transmission of the data from the Pioneer 11 spacecraft to the National Aeronautics and Space Administration's Ames Research Center in California last week. In place NASA has a series of dollar signs, printed by the computer receiving the data as an indication that it was unintelligible.

At first it was thought that all the relevant data, which came from readings made by an infrared radiometer aboard the spacecraft and would provide important clues about the planet's atmosphere, had been lost. However subsequent investigation showed that the data had been received — but in a highly garbled form. NASA scientists are now trying to unscramble what they can; they are confident that some of the information can be retrieved, but remain uncertain about its quality.

"The data was ratty, make no mistake about that. But it's there, and it may all be there, all 20 minutes of it, ground up in some scrambled data that was fouled in the communication link between Madrid (one of the three receiving stations for Pioneer transmissions) and California," mission chief scientist Dr John Wolfe said last Thursday.

Late last week, the precise cause of the radio interference was still uncertain. Initially it was stated that the interference had been caused by a Soviet satellite in Earth orbit, Cosmos 1124, which NASA

"It's the Titans! They say if we want to take pictures we can pay for them!"

officials had forgotten to ask Soviet scientists to switch off during the period in which the Pioneer data was being transmitted.

On Wednesday, the space agency issued a statement identifying the satellite as the cause of the problem. The statement continued: "NASA officials indicate that they have no doubt that the Soviets would have avoided the conflict on Monday, if they had been asked. However the impact of the potential interference was not recognised in time to make an additional request to the Soviets."

By the next day, however, NASA had changed its mind about the cause of the interference. Rather than the Soviet satellite, they now blamed the combined effect of a solar storm and low quality land transmissions between Spain and California — an explanation which had been put forward at the very beginning, but rejected when the Cosmos satellite's involvement had become known. □

Bulgaria plans to save energy

During the next Five Year Plan (1981-1985), all Bulgarian "energy consuming enterprises" will become subscribers to *Promishlena Energetika* (Industrial Energy), an organisation established this summer and described by Energy Minister Nikola Todoriev as "a scientific production combine". The main purpose of *Promishlena Energetika* is the saving of all forms of energy across the economy; its activities range from the reconstruction and modernisation of existing installations to an extensive research and development programme.

What precise form this research would take, the Minister did not specify. He was addressing a symposium on "Fuel and Energy saving and new energy resources" held in conjunction with the annual Plovdiv trade fair. Scientific seminars at the Fair were introduced some ten years ago, and, according to Penko Penkov, Chairman of the Bulgarian Chamber of Commerce, are the response of the organisers to the information explosion.

"Rapid technical progress makes us organise scientific and technical symposia", said Penkov, "in order to give experts from many countries a chance to keep up with the latest developments". This year, there were no less than twelve day or half-day seminars on subjects ranging from ergonomics, geodesy, and the stimulation of scientific creativity to textile and leather technology and the bacteriology of yoghurt. The three day energy symposium, however, with its massive foreign participation and the full

panoply of simultaneous translation, undoubtedly dominated the scientific events.

Foreign participation, indeed, was the major feature of the symposium. Apart from the Minister's speech, there were four Bulgarian contributions (on geothermal and solar power, hydrogen fuel and secondary power sources). Otherwise, with the exception of one Polish contribution, all papers were contributed by Western experts, ranging from nuclear to hydraulic power sources, and from general policy to specific devices.

This willingness to borrow Western achievements is nothing new to Bulgaria. One exhibit at Plovdiv — that of the *Progress* organisation, established last year to help bridge the gap from research and development to large scale implementation — carried as its motto a quotation from Mstyslav Keldysh, late President of the Soviet Academy of Sciences, that it is not the nation which

makes the first breakthrough who enjoys the benefits of a discovery but the one which implements it properly.

In 1976, said the Minister, when Bulgarian energy policy was revamped with the establishment of the National Energy Complex, Bulgaria had reached the position of one of the most developed nations in the world "in the energy sector at least" having increased specific consumption per head from 9% below world average in 1953 to twice the world average.

The new policy took a three-fold approach, stressing increased exploitation of local resources (mainly lignite), an expansion of nuclear generating capacity (which will reach 35% of the total generating capacity by 1990, with subsequent introduction of nuclear district heating for Greater Sofia) and a major programme of energy-saving.

In spite of massive efforts at economy by industry and domestic consumers alike,

these "passive measures" are not considered to be sufficient. Modernisation of existing plants, training of personnel to get the best use from their apparatus, and even the introduction of automated control systems for energy-intensive processes will all peak by the mid 1980s — leaving further gaps to be filled. These, stressed the Minister, can only be satisfied by new technologies.

Some of these will, of course, be of Bulgarian origin. Todoriev mentioned a new Bulgarian scheme, already in operation at the Maritsa-Istok-3 power station, which allows lignite to be burned without predrying — giving an overall fuel saving of some 5%. Others, including solar energy, the use of the geothermal waters of the Rhodope mountains, and the pressing problem of secondary energy resources, may well, if one judges from the Plovdiv seminar, rely considerably — at least in the early stages, — on foreign know-how.

Vera Rich

Pugwash calls for new efforts to control chemical weapons

The Pugwash Workshop on Chemical Warfare has joined impatient voices calling for progress in negotiations on a chemical weapons (CW) disarmament treaty. At a meeting in Stockholm recently, the Workshop urged that the current situation in the negotiations be re-appraised for the Biological Weapons Convention Review Conference, scheduled for 1980. The Review Conference is charged with assessing progress in CW disarmament as well. Most members of the Pugwash group also advocated the reopening of multilateral negotiations on a CW treaty, for there is a major weakness in the Biological Weapons Convention is that it allows research into new biological agents for 'defence'.

Since 1976, the US and the USSR have been having secret talks about chemical weapons disarmament — a subject earlier discussed at the multilateral Geneva Disarmament Conference. But the superpowers' bilateral talks have made no progress. They have instead taken the wind out of the Geneva negotiations, and many of the delegates to the Disarmament Conference have expressed themselves impatient with the stagnation. For example, the leader of the Swedish delegation, Mrs Inga Thorsson, tried recently to move things along when she suggested that the conference should begin its own CW negotiations in parallel with the superpowers. The Pugwash group urged the reopening of multilateral negotiations irrespective of the state of the bilateral talks.

A CW capability consists of different elements: laboratories for research and development, facilities where the weapons are made, and facilities where they are stockpiled. Any treaty aiming at CW

disarmament must deal with all these different elements. The Workshop considered them in turn, asking for each whether it would be better to destroy it or convert it to civilian use, and how such measures could be verified.

Pugwash, a private affiliation of scientists interested in disarmament questions, is not an official government body, but it provides a useful arena for its members from east and west to test ideas and atmospheres. The temperature of the official negotiations can be said to be above freezing simply because the Pugwash group is still functioning. At this meeting, the 30 participants produced nothing dramatic; but some of them (who preferred not to be named) were prepared to point to parts of its report with cautious optimism.

It was, for example, said to be a hopeful sign that the report contains a list — agreed by both sides — of six infrastructural recommendations for the verification of the destruction of declared stockpiles. Perhaps the most interesting of these points are that whatever international body is established to verify the destruction, it should have an independent technical capability, and that continuous presence of monitoring personnel at the destruction site would be necessary. The latter does not mean that the USSR, after years of refusing on-site inspection, has decided to allow them after all; but the report reflects agreement on more details of on-site inspection, and in this sense it may indicate a slight softening of the Soviet attitude.

What did emerge, however, from a visit the group made to the Swedish pharmaceuticals factory KabiVitrum AB, is that that on-site inspection need not jeopardise commercial secrets. In recent years, the Workshop has visited

commercial chemical factories in West Germany and the United States, and a US Army chemical/munitions disposal facility.

Next year, the group plans to visit a site in East Germany. The visits have enabled the group to explore verification questions which could arise under a CW convention. Invasion of chemical factories by inspectors has long been opposed on grounds of commercial privacy; but as the Pugwash group visits more facilities in more countries, its experience suggests that opposition to some forms of international control of the chemical industry rests on shaky ground.

It was also reported that the discussion on confidence-building measures (CBM's), provoked more reaction than usual. CBM's are steps the sides can take to increase mutual trust: voluntary exchanges of technical and methodological information on chemical research and development related to CW problems, for example. The more trust there is between the sides, the fewer formal verification procedures are needed. Various CBM's have been discussed by previous meetings of the Workshop, but this one produced an additional concept for increasing mutual trust: 'obligatory CBM's under a CW convention'. The group felt that it could be useful to treat certain sorts of treaty provisions as CBM's: provisions, for example, which might be valuable but difficult to verify under a treaty. The discussion on CBM's was laced with controversy about which measures would be best to adopt; and at least one participant was surprised that both sides agreed to mention them favourably in the report.

Wendy Barnaby