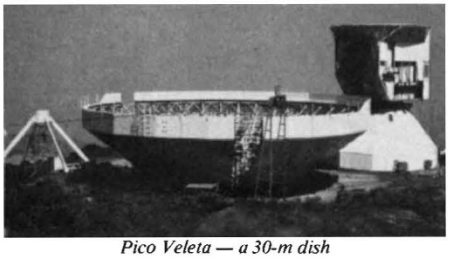
# Japan reaches for the stars

## Radio-dish looks set to excel

Japan is now poised to take a world lead in millimetre-wave radioastronomy — the study of molecular clouds and star-formation regions — thanks to a far-sighted decision by the Japanese Ministry of Education more than a decade ago to support the plans of Tokyo Observatory.

For while American molecular astronomers smart under the effective abandonment of their own country's plans for a large (25-metre) dish to operate in this wavelength range (see *Nature* 12 August, p.596), Professor Kenji Akabane of the Tokyo Obervatory will announce this week at the International Astronomical Union meeting at Patras, Greece, his first observations with a 45-metre dish and a 5 × 10-metre-dish interferometer — a combination which is likely to outclass the millimetre-wave equipment of other nations for a number of years.



*Pico Veleta — a 30-m dish*

This telescope complex, which took 13 years to construct and cost £20 million, is now in operation at Nobeyama, 200 km north of Tokyo.

There is only one doubt about the telescopes — that they are sited in Japan. There they are limited by a relatively humid atmosphere, which absorbs low wavelengths. Thus, said a British millimetre-wave radioastronomer this week, Japan may be restricted to measurements at wavelengths not much shorter than 1 cm, which in molecular terms means a limitation to the observations of relatively rare long molecules. Studies of isotopic abundances in the Universe — an important project for millimetre-wave astronomy — need shorter wavelengths. The Tokyo observatory, however, reckons that Nobeyama will reach down to 2 mm.

If the Nobeyama telescope fails to reach down that far there is a chance that it will be suspassed within a few years by other millimetre-wave telescopes, planned or under construction.

France, Germany, and Spain will be next, with the £15-million Institut de Radioastronomie Millimetrique (IRAM). IRAM has an administrative headquarters in Grenoble and two telescope sites: one in southern Spain, on Pico Veleta near Granada, and one in the southern French Alps at the Plateau de Bure.

Pico Veleta is to have a 30-metre dish, whose steel-work is nearly complete — but the telescope is unlikely to be taking data before early 1984. According to Dr Dennis Downes, one of the IRAM team, this telescope should reach down to 1-mm wavelengths. But doubts have been expressed about that objective: the IRAM telescopes are to be open to the air and Sun, and so they will be distorted by wind and differential solar heating.

The exact shape of the dish must be maintained to within a wavelength of the radiation being studied — in other words 1 mm. To achieve this, the steelwork of the Pico Veleta telescope is to be heated to a uniform temperature; and the Plateau de Bure 15-metre dishes (of which there will be three making a T-shaped interferometer) will be stiffened with carbon fibre, cost allowing. Whether these untried methods will achieve the necessary accuracy is yet to be seen. Moreover the interferometer, will take some time to construct.

Besides IRAM, Britain, together with The Netherlands, plan to build a £7-million, 15-metre dish in Hawaii. These plans require environmental approval by the Hawaii State legislature, expected towards the end of this year. The British–Dutch dish, protected by a dome transparent to the radiation, should reach down almost to the edge of the millimetre-wave atmospheric "window" at 0.35 mm. But observations are not expected there before 1986.

Thus Japan is likely to enjoy a substantial lead in this branch of astronomy, possibly the first basic science in which it might take a world lead, at least until 1984.

**Robert Walgate and Alun Anderson**

# Remote sensing for all at UN

*Vienna*

Remote sensing capabilities are emerging as a keynote of Unispace-82, the Second United Nations Conference on the Peaceful Exploration and Utilization of Outer Space, now taking place in Vienna. Virtually every national delegation expressed its committment to, and hopes for, remote sensing, and although some delegates privately expressed the views that remote sensing was still a solution in search of a problem, such sentiments were kept strictly outside of the official proceedings.

Remote sensing, for example, is to be the mainstay of the United States "global habitability" programme which is expected, during the 1980s, to develop into an umbrella for the research scheduled for the US space platform. "Global habitability" is intended to open up the entire land mass of the Earth to human habitation.

Yet the use of such techniques to survey another country contains the seeds of international tension. One of the problems to which remote sensing is repeatedly urged as a solution is the more rational use of land resources. But such techniques inevitably cut across traditional concepts of national and even personal privacy. The Soviet Union is a strong supporter of new international legislation to outlaw the improper use of data gained by satellite. As Dr Andrei P. Kapitsa, director of the Soviet stand at the exhibition associated with Unispace-82 pointed out, the publication in the Western press of predicted shortfalls in the Soviet harvest (based on satellite data) immediately raised world wheat prices, causing an extra drain on Soviet hard currency reserves.

Significantly, one of the most fervent pleas for the establishment of international principles on the use of satellite data came from Brazil, a country frequently quoted as a classic case where only remote sensing can provide adequate survey facilities. President Joao Baptista de Oliveira Figueiredo spoke of remote sensing as an "instrument both valuable and dangerous" since it "impinges on the sovereignty of states over their natural resources".

The problem becomes even more complex with marine resources. One of the greatest advantages which Cuba derived from participation in the manned "Interkosmos" programme, according the Cuban cosmonaut Arnaldo Tamayo Mendez, was the discovery of new fishing grounds. However, although one of the purposes of Unispace-82 was to show third world countries what space techniques are available, and although the European Space Agency has recently offered African states experimental facilities aboard Spacelab some 25 per cent of the nations represented in the United Nations have not yet reached a level of development where participation of any kind in a remote sensing survey is an economic possibility. The use of satellites to determine fishshoals in international waters could mean that those shoals fail to reach the traditional fishing grounds of the disadvantaged nations.

To obviate such inequities, some speakers at the forum of non-governmental organizations (NGOs), which took place in parallel to the main sessions, urged that the third world should strive for its own launch capability, but without clearly suggesting how this might be achieved. More practical would be the creation of an international pool of land-resource data as part of the United Nations committment to space. The two space superpowers already have a data-pooling

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programme, which is apparently continuing, although, as the administrator of the National Aeronautics and Space Administration, James M. Beggs, made it clear there can be no resumption of joint US–USSR experiments or missions until the international political climate improves considerably.

Several countries including India, France and the host country, Austria, have already established their own cooperation programmes with both the capitalist and the socialist worlds. Yet it was occasionally difficult to pin down the delegates from these countries on the advantages their countries have derived from such cooperation. And the Polish cosmonaut, Miroslat Hermaszewski, expertly fielded the question of what benefits Poland had derived from participating in the Comecon space programme — although, only a few metres away, the Polish Institute of Cartography had on display an excellent series of maps, which synthesized data from both the Interkosmos and the Landsat programmes.

**Vera Rich**

Remote sensing satellites

# French plans for spot satellites

The French national space agency, the Centre National d'Etudes Spatiales (CNES), believes there is money to be made by remote sensing from space. Sales of data recorded by the two Spot satellites, France's first national remote sensing satellites due for launch in 1984 and 1986, are expected to offset the capital cost of the satellites' development and running costs in about ten years. Responsibility for earning the revenue will rest with Spot-Image, the independent company created early last month to market Spot data worldwide.

CNES's approach to the commercialization of remote sensing data differs markedly from that in the United States. The US National Aeronautics and Space Administration (NASA), like CNES chiefly a research and development agency, has been an unwilling operator of the service forced upon it when data from the early Landsat satellites proved commercially attractive. Potential users have complained that NASA was sometimes insensitive to their needs.

NASA will indeed be administering the distribution of data from Landsat-D, the latest satellite in the series launched last month, and from Landsat-D′, its successor, but beyond 1987 the Reagan Administration has insisted that NASA will have to get out of commerce so that the operational service will have to be taken up by private industry. Thus the fortunes of Spot-Image will be keenly watched in the United States as well as by the European Space Agency, now debating how to make available data from its planned remote sensing satellite ERS1, and the British government, which is contemplating a major effort in remote sensing.

Spot-Image's main shareholders are CNES with a 34 per cent holding, three French government agencies each with 10 per cent — the Institut Cartographique Nationale, the Institut Français du Petrole and the Bureau de Recherche Géologique des Minières — and two companies, Matra and Societé Européen de Propulsion, with 7.5 per cent each. Organizations from Sweden and Belgium which have collaborated to some extent on Spot, will also have small sharehodings. Spot-Image will buy data from CNES and sell them.

NASA's early experience in selling remote sensing data, however, seems not to augur well for Spot-Image. Although there has been great interest in Landsat data, there has been no prospect that fees would match development costs. But, according to Gérard Brachet, director-general of Spot-Image, the market for data from the second generation of remote sensing satellites should grow by leaps and bounds — he reckons that Spot should earn about $900 million, to cover development and running costs, within ten years.

The chief advantages of Spot and Landsat-D over earlier generations of remote sensing satellites is their increased resolution and number of spectral bands. Spot, for example, whose chief instrument is a multilinear array, will observe in three bands in the infrared and visible regions of the spectrum with a ground resolution of 20 m and in a broad band with 10 m resolution. Stereoscopic images are also available.

Spot data will be received and interpreted in Europe at ground stations in Toulouse (France) and Kiruna (Sweden). Spot-Image plans to turn round data within 48 hours for dispatch to users. The charge for one scene in digital form is expected to be about $1,000, but the fee for a photographic image has yet to be worked out, although it will be less. Brachet is confident that prices will compare favourably with those for images generated by the multi-spectra scanner aboard Landsat-D although comparisons with the thematic mapper, Landsat-D's most innovative instrument, are more uncertain.

Spot-Image is negotiating with some countries to receive Spot data direct via their own Earth stations, in which case there will be a copyright fee of only about FF220 ($40) per scene, less than the cost of images bought from Toulouse or Kiruna. The apparent discrepancy is explained, according to Brachet, by the prospective loss of about 70 per cent of potential images due to cloud as well as the cost of processing images.

**Judy Redfearn**

# South African funds

The UK Science and Engineering Research Council (SERC), is reviewing its future commitment to the South African Observatory (SAO), because of financial pressures. South African astronomers currently take up 65 per cent of the viewing time of SAO, and SERC "buys" the rest for UK astronomers; has been suggested that this proportion be decreased. A recent questionnaire, however, revealed a strong desire within the UK astronomical community for this level of involvement to continue.

In terms of technical sophistication and size, the telescopes of the SAO (near Capetown) are outranked by others available to British astronomers in the Southern Hemisphere, particularly the Anglo-Australian and UK Schmidt telescopes in Australia. Paradoxically, SAO's usefulness is increased because its telescopes are not so advanced as to be oversubscribed in demand and yet are sufficiently powerful to do valuable work. In particular, SAO is heavily used for optical and infrared photometry with such objects as the brighter active galaxies and also cataclysmic variable and Cepheid-variable stars.

Earlier this year, while reviewing its plans for the financial year 1983–84 and the following three years, the Astronomy, Space and Radio Board of SERC set up a working group to ascertain the need for continuing use of SAO. The group circulated a questionnaire, to which it received replies from 60 or so groups in the United Kingdom. SERC says the working group reported to the board in July that there was a strong user demand for SAO.

The position of the board is that the decision will depend on scientific and financial considerations and that political issues are not relevant. According to SERC, however, a handful of the questionnaires raised political reasons for discontinuing the use of SAO. One astronomer, Dr Michael Rowan-Robinson, who has just completed a period of service on the SERC committee responsible for SAO, feels particularly strongly: "I seem to be in a minority in feeling that SERC should not maintain an official link of this kind with the South African government. Use of the telescope should be left more to the consciences of individual astronomers."

SERC is due soon to start negotiating its next contract with SAO, to which it now pays about £240,000 a year (about 25 per cent of the annual budget of the observatory) for 35 per cent of the total observing time. The British astronomical community will have a chance to review its use of all observatories in the Southern Hemisphere at the Anglo-Australian Telescope symposium to be held next month.

**Philip Campbell**

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