Voyager 2

Uranus is something else again

Washington

A NEW kind of atmospheric emission that has been called "electrogrow" was one of the most striking results of the Voyager 2 flyby of Uranus, according to Dr Ed Stone, project leader. Electrogrow, observed by Lyle Broadfoot, head of the ultraviolet spectrometry team, is believed to result from a different process than either aurora or airglow. Aurorae are caused by the precipitations of charged particles in the polar atmosphere. Airglow is the result of high-frequency solar photons in the atmosphere. Electrogrow also needs solar photons to ionize constituents of the atmosphere, but thereafter some unknown mechanism seems to provide energy to the electrons to cause the glow. The glow is observed only on the dayside of Uranus, in the ultraviolet; it had been observed before on Saturn and Jupiter, but only at Uranus did it "become clear that this was a totally new phenomenon", according to Stone. In comparison with aurorae, electrogrow is caused by very-low-energy electrons very high in the atmosphere.

The uranian magnetosphere contains mainly protons, rather than helium nuclei, for which the uranian atmosphere is the most likely source, according to S.M. Krimigis. There is in addition a warm plasma of a hundred thousand degrees and a very hot plasma of ten million degrees, reported by Fran Bagenal. Explanations for these observations have yet to be made.

The rotation period of the planet has been measured and is close to 17 hours, not too different from estimates made on the basis of the rate of precession of the rings. The magnetic field of about 0.25 gauss, with its peculiar 55 degree inclination from the rotational axis, will doubtless provide fodder for theorists for years to come.

Most of the moons are greyish in colour, suggesting that meteoritic material (together with water ice) is their main constituent. A reddish coloration would have argued for more hydrocarbons resulting from irradiation of methane.

Sizes and densities of the moons have been established; the densities of the four for which data are so far available are about 1.6, suggesting a composition of 50 per cent water ice and 50 per cent rocky material.

The uranian atmosphere was found by radiooccultation and other techniques to consist of about 12 per cent helium (plus or minus four per cent); the remainder is mostly hydrogen. This result, reported by Len Tyler, is consistent with solar composition and in accordance with expectations. A methane cloud layer at about 1.6 bars was detected; water and ammonia

were not detected directly but are presumed to exist at much greater depths.

It is clear that Uranus does have an internal heat source, but no estimate has yet been made of its size. Part of the evidence for this is that the poles are not warmer than the equator, as expected in a planet whose axis of rotation is in the plane of its orbit around the Sun. Winds on Uranus rotate in the same direction as the planet itself, also unexpected for the same reason.

New rings around the planet were discovered, but attempts to number them give rise to problems of definition, according to Jeff Cuzzi. In any event, material was found orbiting the planet both inside and outside the previously known rings. One of the surprises of the mission is that there

are few particles smaller than about a metre in diameter, in contrast with the rings of Saturn and Jupiter. One possible explanation is that if the uranian magnetic field wobbles, small particles might become magnetized and get swept out the ring; atmospheric drag might also provide an answer. Of the ten new moons discovered, at least two appear to be shepherd moons for rings.

Many of the questions raised by these preliminary results will be stated more carefully, or even partly answered, by the time the 30-day post-encounter report is completed, according to Stone. Now, the hundreds of visiting scientists who have been working at the Jet Propulsion Laboratory in Pasadena, California, for the past several weeks in preparation for the encounter have started to head for home. But the new data gathered should keep many of them busy for years.

Tim Beardsley

Soviet environment

Now pollution on television

THE new Soviet television series, "Problems, Searches and Solutions", in which experts discuss viewers' questions on key issues of the national economy, dealt on 24 January with environmental protection and natural resources. Since the programme was launched last November (see *Nature* 318, 593; 1985) the format has been changed; no attempt is made to create the illusion of off-the-cuff replies to telephone questions. Nevertheless, the pre-selected questions dealt with by the panel not only reflected a growing public interest in environmental matters, but also pinpoint a number of areas where Soviet policy needs to be strengthened.

The most striking feature of the programme is the large number of experts empanelled. Apart from Dr Yurii Izrael, chairman of the State Committee for Hydrometeorology and Environmental Control, it included a minister, a deputy minister, a vice-president of the Soviet Academy of Sciences and representatives of two other state committees and a government commission.

The discussion showed only too clearly that many of the most serious issues, such as the protection of small rivers, come under the jurisdiction of at least three of these bodies (State Committee for Forestry, Ministry of Land Reclamation and the Commission of the Presidium of the USSR Council of Ministers for the Protection of the Environment and natural resources), to say nothing of bodies involved in the long-term Food Programme.

Similarly, the drainage of forest marshland in Lithuania and Byelorussia turns out to involve not only the same three governmental bodies, but also a Byelorussian research institute working on the cul-

ture of heavy-fruited cranberries in natural marshland or industrial plantations. Environment could well benefit from the kind of superministry recently established for agriculture, as part of Mr Mikhail Gorbachev's drive to streamline the economy.

The Gorbachev reforms have undoubtedly made it easier to discuss past mistakes in environmental planning. Both *Pravda* and *Izvestiya* have given extensive coverage, in the past few weeks, to the environmental threat from the two cellulose combines on Lake Baikal which, in spite of expensive purification installations, still continue to endanger the lake.

Dr Aleksandr Yanshin, vice president of the Soviet Academy of Sciences, pointed out in the television programme that the pollutants discharged by these combines are incorporated in the shells of the minute crustacean, *Epischura baikalensis* which, when it dies, carries the shell to the bed of the lake. But the life-cycle of *E. Baikalensis* is short, and the bed conditions of the lake play an important part in maintaining the exceptional purity of the lake water under natural conditions; even a relatively small discharge of pollutant is a considerable threat.

The chairman of the Committee for Forestry admitted that, although over-felling had been reduced by some 80 per cent over the past fifteen years, some 12 million m³ of wood is still being over-felled every year, thus violating "the basic principle of timber use". But only a few years ago, over-fulfilment of targets was urged in every sector of the Soviet economy, including forestry. Some officials may not yet have made the necessary mental adjustment to the new circumstances.

Vera Rich