

## Halley's comet

## Europe's hopes for second probe

GIOTTO, the European Space Agency's first interplanetary satellite, designed to intercept Halley's comet, should be backed up by a second version which could be built at relatively little extra cost, some Europeans claim. Spare parts and a spare framework are already available, and could be assembled to make a Giotto II.

British Aerospace, prime contractors for Giotto, was not prepared last week to quote a price for such a project but, according to some estimates, a second Giotto, including launch, would cost only half as much as the current mission: another £50 million on top of the present £100 million.

The advantages of a second Giotto would be as a safeguard against the failure of the Ariane launcher, two of whose last six launches have failed. But if that launch were successful, a second Giotto could provide a matching experiment to send to another comet. The other missions to Halley, the Soviet Union's Vega craft and Japan's Planet-A and MST-5, are already double missions.

"This is a hot potato in ESA (European Space Agency) at the moment", said a Giotto specialist last week. It would put the £80-million-a-year ESA scientific programme back only a few months, he claimed, saying that it is "up to the scientific community" to decide whether it wanted to do it.

One planetologist in favour of a second spacecraft is Tony McDonnell of the University of Canterbury. He has already proposed a mission called Comex, which would be a modified Giotto II designed to intercept a number of comets by using direct orbital injection from Ariane and by carrying a liquid fuel motor aboard. Comets differ greatly from one another, McDonnell points out, some bursting, others splitting with a variety of tails and emission characteristics, and there is a danger that the Halley data will give too selective a view of cometary structure and chemistry.

ESA planners, however, take the view that any modification of the tightly-designed Giotto mission would entail its total redesign and thus destroy the advantages of using Giotto spare parts. Giotto uses a solid fuel booster which can only be fired once to reach its interception orbit

with Halley, and so a Giotto II could be used effectively only for another single comet.

There may, however, be other arguments for a Giotto II. Giotto will go far closer to the comet nucleus than any other mission. (The closest approach will be less than 1,000 km, compared with upwards of 10,000 km for the Soviet and Japanese probes and for the American ISEE satellite recently diverted to comet Jacobini-Zimmer.) So, says Giotto's project scientist Ruediger Reinhard, Giotto has only a small chance of surviving the encounter.

Moreover, it is now clearly admitted, impacts with cometary dust in at least the last "tens of seconds" of the 30-minute passage of Giotto through the cometary coma to the nucleus are likely to throw out the close (1°) alignment of telemetry with the Earth, so that the last portion of data is in danger of being lost. And this assumes the dust cloud to be uniform; if Giotto were unfortunate enough to meet a jet of emission (such as are observed), misalignment would occur earlier.

There will be attempts to steer Giotto between any jets observed from Earth by taking the best straight-line path. But it is agreed that the whole exercise is risky. "We will know the risk sometime between 1830 hrs on 13 March 1986 and 0330 hrs on the next day", when the encounter takes place, said a British Aerospace spokesman.

● A rumour is circulating at the British Aerospace Dynamics Group near Bristol, where Giotto is being assembled, that Mrs Margaret Thatcher the British Prime Minister has enquired of an official whether Halley would be destroyed if Giotto targetting were so good that the satellite hit the nucleus (which is believed to be about 3 km in radius). The political consequences of such a conflagration would clearly be incalculable. But whether or not the question was actually put, British Aerospace did tackle the calculation. Little damage would be done, it seems, even though the impact would take place at 68 km per second. This velocity gives Giotto kinetic energy equivalent to about 250 kilotons of TNT, but the latent heat of melting of the cometary snowball would be some 100 million times greater.

Robert Walgate

## European pollution

## West Germany takes the lead

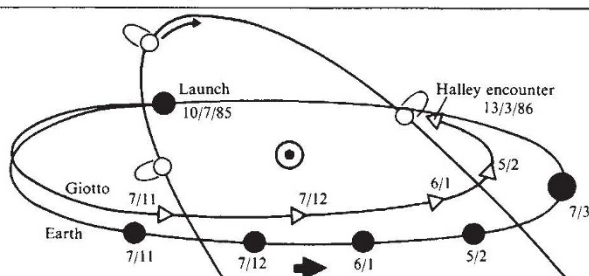
WEST Germany is well on its way to leading the European Economic Community (EEC) in environmental legislation. The impetus is the growing anxiety about the condition of West German forests (see figure opposite, and *Nature* 307, 97; 1983). A government committee, *Der Rat von Sachverständigen für Umweltfragen*, has now stressed that the phenomenon "can no longer be explained on the basis of traditional forest experience", but that acid air pollution must be an important contributory cause. But there are now also fears that air pollution is increasing mortality among the vulnerable trees — the old and the very young. Mortality among the young may be especially severe in West Germany, which now has the lowest success rate for new trees in the world.

The response to the anxiety has been impressive. In a debate in the Bundestag, the Federal Minister of the Interior, Dr Friedrich Zimmermann outlined a series of measures being taken in West Germany. The federal government is spending DM56 million (£14 million) a year on research related to forest death (compared with an estimated £0.5 million in the United Kingdom. Individual *Länder* are also reacting — Baden-Württemberg, which sent a delegation to Japan to investigate power-plant desulphurizing techniques, now has three pilot plants built at a total cost of DM 60 million (£15 million) without federal or EEC support.

West Germany emits 3.5 million tonnes of sulphur dioxide a year into the atmosphere, 43 per cent of it from power stations. Regulations introduced last year set the emission levels for new power plants at 1,800 mg m<sup>-3</sup> and twice that for old plant. The utilities claim the new regulations will cost them DM10,000–15,000 million (£2,500–3,740 million); 20–30 per cent of the cost of new plant is already attributed to measures designed to protect the environment.

The West German environment council is nevertheless pressing for the emission levels to be further reduced, perhaps closer to the Japanese limit of 100–500 mg m<sup>-3</sup>. Even so, new regulations would reduce total annual emission of sulphur dioxide to 0.55 million tonnes a year within 10 years. (The opening by *Rheinischen Braunkohlenwerke* AG of what will be the largest brown coal mine in the world, with reserves of 2,500 million tonnes to be exploited over the next 50 years, may make that harder to achieve.)

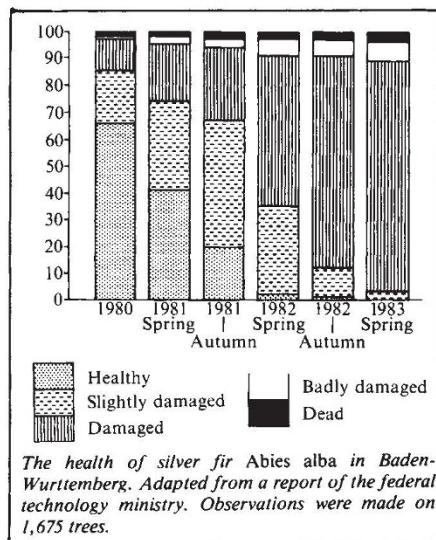
Nitrogen oxides from vehicle exhausts are another target for current concern. One controversial estimate is that the introduction of a speed limit, of 80 kilometres per hour in general and 100 kilometres per hour for autobahns, would reduce emis-



The orbits of Halley, Earth and Giotto, assuming a launch on 10 July 1985.

sions of nitrogen oxides by 13 per cent. But the German speed lobby has more than a little in common with the gun lobby in the United States.

In the European Communities as a whole, forest covers one-fifth of the total land area (some 35 million hectares) and provides employment for 1.4 million people. Nevertheless, the EEC is an importer of wood, bringing in 60 per cent of its needs in 1980.



Damage to forests such as has been found in West Germany is widespread throughout the Community and two proposals for directives are now being considered in Brussels. One would limit emissions from large installations to 250 mg m<sup>-3</sup> by 1995 and reduce total emissions by 60 per cent for sulphur dioxide, 40 per cent for nitrogen oxides and 40 per cent for dust. The height of flue stacks would not be allowed to exceed 200 metres except under exceptional circumstances, limiting long range transport of pollutants. A second proposal on nitrogen oxides would forbid air concentrations above 200 mg m<sup>-3</sup> for more than 2 per cent of the time. Both proposals include requirements for strengthening the monitoring system and supplying environmental information to Brussels.

Not all the economic considerations are negative. A study commissioned by the EEC estimates that air pollution from sulphur dioxide and nitrogen oxides costs the Community US \$1,400–4,200 million a year without taking account of damage to historic monuments and setting the cost of damage to public health at only \$20 million. The cost of control measures for large installations is estimated at \$370 million per annum for 25 years.

**Sarah Tooze**

● THE environment committee of the European parliament has now entered the fray on acid rain. The committee last week tabled a heavily critical report based on public hearings and written evidence, in which it claims that damage caused by acid dust and rain goes beyond even the 3–5 per cent of European community gross

national product estimated by the Organization for Economic Cooperation and Development. The report calls for heavy investment in smoke-scrubbing equipment, rapid legislation to limit emissions and for more research.

On Monday, the chairman of the committee, Scottish Labour MEP Kenneth Collins, said he hoped to put heavy pressure on the European Commission, and the decision-making council of ministers, to take action. There is "widespread agreement" in the council, said Collins, but one member state — the United Kingdom — was resisting all measures in the absence of incontrovertible evidence both of acid rain damage and of the origin of the acidity.

But evidence of this kind will never be watertight, says Collins. Moreover, the United Kingdom wished to wait at least until the findings of the Royal Society study, performed in conjunction with CEBG and the National Coal Board, and this might take five years.

Collins is hoping for some pressure on the United Kingdom from the French, during the present six months' French

presidency of the European Council. France is only just beginning to feel the effects of acid rain, largely in the Vosges in the east of the country, but it is more willing to act than the United Kingdom, Collins believes.

Meanwhile further pressure may come from the environment committee of the UK House of Commons, which will begin an investigation of acid rain within the next few weeks. Members of the committee will be visiting European countries including West Germany and Scandinavia.

And acid rain is now beginning to cause fears outside Europe and the United States, according to the International Union for Conservation of Nature and Natural Resources (IUCN). In response to a worldwide request for information, IUCN has learned of fears in South Africa for the Eastern Transvaal Highveld, which lie downwind of coal-oil conversion plants and coal-fired power stations centred on Witwatersrand and Johannesburg, and acidification down to a pH of 3.7–4.7 in San Paolo State, Brazil. IUCN has established a task force to study the worldwide effects of acidification. **Robert Walgate**

### Afforestation

## UK woodland policy disputed

A REVIEW of forestry policy in the United Kingdom by the British Association of Nature Conservationists has now concluded that the decline of ancient semi-natural woodland in Britain is being encouraged by a tax loophole. The review, entitled *The Future of Forestry*, endorses a Treasury study of 1971 which found that new afforestation is not justified in the national interest either strategically or economically. That report was overtaken by political events and by a government decision in favour of afforestation.

Now, according to the conservationists' report, private foresters are able, by changing ownership when a plantation becomes profitable, to switch between tax schedules so that initial costs are set against other income while productive stands are taxed only at their land value. The Inland Revenue accepts that these provisions are being exploited by syndicates of high-rate taxpayers but appears unable to remedy the situation. The annual loss through this "unscrutinized subsidy" may be up to £25 million.

Plantation with conifers, which give better commercial returns, often has damaging effects on wildlife, says the association. This is true especially where a high proportion of the land area is covered, as in parts of southern Scotland. The association recommends that the Forestry Commission, which is now disposing of many of its plantations in accordance with government policy, should cease further coniferization and that it should recommend private foresters to do likewise.

The report also bemoans the conser-

vation grant system which allows the Department of the Environment, through the Nature Conservancy Council, to buy woodland thought worthy of conservation from the Forestry Commission, which simply returns the money to the Treasury.

The Forestry Commission has yet to consider its reply to the charges made against it, but officials say that the decline of ancient woodland will not continue under present policies and that the commission already encourages plantation of broad-leaved woodland.

Private foresters are represented by the Royal Society of Foresters in England and Wales. Mr Esmond Harris, director of the society, objects to foresters' taxation arrangements being described as "manipulation". "They are," he says, "an incentive comparable with the government's Small Business Investment Scheme." And he argues that it is "sensible" to expand the home base.

Mr Harris also challenges the view that afforestation with conifers is damaging to wildlife interests. He claims the re-establishment of goshawks in Britain and the increasing numbers of golden eagles as proof of this, citing the support of scientists at the Institute of Terrestrial Ecology for this view.

According to Dr Ian Newton of the Institute of Terrestrial Ecology, the main complaint against coniferization is when it is done in blanket fashion. He also points out that, as the golden eagle needs open ground in which to hunt, its recovery can hardly be claimed as a success for forestry policies. **Tim Beardsley**