SPACE

Meteosat's turn

Judy Redfearn reports on Europe's latest satellite

METEOSAT, Europe's first satellite devoted entirely to watching the weather, was scheduled for launch this week from Cape Canaveral into a geostationary orbit 35,900 km above the equator. But a valve in the second stage of its Thor Delta 2914 launcher developed a leak last weekend. NASA has announced that the launch will be delayed, until it can replace either the launcher or the valve.

When Meteosat finally arrives in its planned orbit it will take images of the earth's surface and cloud cover both in the visible and infrared which will be used by European meteorological services to improve their long range weather forecasting. The idea to build a geostationary meteorological satellite was included in the European Space Agency's (ESA) optional application programme in 1971.

Meteosat will, in fact, be only the first of several European meteorological satellites. The second is already approved and should be ready for launch in the early 1980s and subsequent ones are under consideration. Meteosat therefore has a dual role: it is partly pre-operational, designed to prove a satellite system, but it is also an important scientific satellite in its own right.

From its position in space, Meteosat will relay back to earth meteorological data on most of Europe, the whole of Africa and the Middle East. Together with four other geostationary satellites positioned symmetrically above the equator, two American (Goes), one Soviet (GOMS), and one Japanese (GMS), it will make weather monitoring of the whole globe possible between latitudes $+50°$ and $-50°$. The five satellites will be taking part in the first global experiment, running from the end of 1978 to the end of 1979, of the Global Atmospheric Research Programme (GARP).

The Japanese GMS was launched last July, and the USA already has three Goes satellites up—two it will use and the third it is storing in space as a spare. But the Soviet Union's satellite, due for launch in about a year's time, is unlikely to be ready because of technical difficulties. NASA's precaution in keeping a stand-by ready may yet save the first global experiment, though no decision on how to replace the Soviet satellite has been taken.

A feature distinguishing Meteosat from other satellites is the way in which the data it generates is processed. Because of the enormous data volume—two images every half hour—all processing must be done in real time. The facility set up especially to do this and to disseminate information to the users is at the European Space Operations Centre (ESOC) at Darmstadt. After the images have been corrected for distortion at Darmstadt, they are relayed back to the satellite and then on to the users.

Should Meteosat itself fail, however, there will be another chance. As with the Orbital Test Satellite, ESA took out insurance for $16 million to cover costs of a replacement launcher and integration of a second satellite. □

SWEDEN

Fälldin's energy puzzle

Wendy Barnaby, in Stockholm, updates nuclear developments in Sweden

CONSERVATION groups in Sweden recently succeeded in stopping a long-disputed application to mine the bulk of Europe's uranium. The application, which the mining company LKAB had previously withdrawn and re-presented taking more account of environmental considerations, was to mine 200 tons of uranium a year for ten years from an area about 350 km south-west of Stockholm, where the uranium deposits are estimated to be the largest in the West in the price range of $10–15 a pound (1968 prices). The local government body used its right to veto any project involving such widespread damage to the environment which, it maintains, is rich in cultural treasures. A spokesman for the company said that it would now begin discussions with the government and that this could lead to a research and development project going ahead, with a small amount of mining to sustain it.

But the action taken over the LKAB application is only one of the pieces, a relatively small piece, of the country's energy puzzle. There are many others that have yet to be fitted in. At the centre of the government's difficulties is the interpretation of the law which specifies the conditions under which the building of reactors may continue. Under the law, the owners of any reactor being planned or under construction must present the government with concrete proposals of the 'completely safe' storage of unprocessed waste or of highly-radioactive waste, if the spent fuel is to be reprocessed. Reprocessing agreements must also have been concluded before the government gives permission for the reactor to be built.

Although the owners of Barsebäck 2 and Ringhals 1 and 2 reactors have concluded agreements with the French Cogema company for reprocessing spent fuel, there is some doubt that the government will recognise the agreements as fulfilling the conditions of the law. This is because of a report prepared jointly by a committee of Cogema's trade unions, employers and safety representatives, which demanded that security at the plant be improved to meet national and international standards and itemised 47 points on which improvements in security and operations in general could be made.

Critics here say that the spirit of the Swedish law demands reprocessing agreements which will guarantee workable, reliable reprocessing. The reactor owners maintain that their responsibility under the law stops with the signing of legal agreements, and that the security matters to be taken care of at the plant are Cogema's business, not theirs. They are happy, they say, to trust the Frenchmen's technical abilities to solve the problems at their end. Overshadowing the entire deal is a query about the American government's attitude. There is no guarantee that the Americans, who supply Sweden with its enriched uranium and can veto the export of spent fuel from Sweden for reprocessing, will allow it to go ahead.

The government must soon decide which interpretation of the law it is to favour. It has given one reprocessing agreement to the state Nuclear Power Inspectorate for comments, and these are expected to be published late in November. The government's decision is expected in December.

December will also see the first of two 'security reports' being presented to the government by the nuclear power industry. The first one will deal with storage of reprocessed spent fuel, and will maintain that safe storage is technically possible. The second, to

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come next spring, will deal with storage of unprocessed waste, and will no doubt be optimistic too.

When the three parties under the prime minister, Mr Fälldin, began their coalition rule, they anticipated difficulty over the nuclear power issue, and they wrote into their common programme the possibility of holding an advisory referendum if they failed to agree. But the consequences of a referendum have changed in the last few weeks, since Fälldin threatened to resign if the vote went against him. So a referendum would simply be an election in another guise. In fact a general election is, according to Fälldin, a distinct possibility.

With Fälldin's position hardening, the government will have to deal with applications expected from the State Power Board early next year to load the Ringhals 3 and Forsmark 1 reactors. The Prime Minister has already refused to allow Ringhals 3 to be loaded once, saying that the State Power Board had not fulfilled the security conditions, and he has recently said that if it is loaded he will resign. March will be no less momentous a month. President Carter is then expected to enlarge on his proposal to store Sweden's (and other countries') unreprocessed spent fuel in the USA. Fälldin's coalition partners are reportedly willing to accept Carter's invitation, but Fälldin is doubtful about releasing spent fuel to storage facilities which have had their own technical troubles. Also in March the Energy Commission is to present its report on alternative energy futures to Parliament. Whether it will be able to come up with some viable transition to environmentally-benign energy production is as yet unknown. But unless it does, Fälldin's tactics seem bound to end in either a devastating loss of face for his party, or in his own resignation. □

Proteins from synthetic genes

BACKGROUNDER

THE most recent technical *tour de force* of genetic engineering to receive attention in the media is the production of the human neurohormone somatostatin from a synthetic gene inserted into bacteria. It was disclosed in a rather unorthodox fashion at a recent US Senate subcommittee enquiry into the need for federal legislation to control research on recombinant DNA. The disclosure was made by Philip Handler, President of the US National Academy of Sciences, who cited the work as evidence for the potential benefits of such research.

There is no doubt that this latest achievement, which is due to a team led by Herbert Boyer of the City of Hope Medical Center in California, is an important technical step forward. Insulin genes were successfully transplanted into bacteria earlier this year, but it has so far proved impossible to get the bacteria to produce insulin from them. Boyer's team, instead of isolating and transplanting a real gene, synthesised a nucleotide sequence corresponding to the sequence of 18 amino acids that go to make up somatotropin. That gave them an 'artificial gene' which they have not only inserted into bacteria, but persuaded the bacteria to decode into somatostatin.

Boyer and his colleagues have been reluctant to disclose details of their experiments because the work is still unpublished. But it seems that the 'artificial gene' was inserted into a plasmid containing part of the bacterial *lac* operon—a package of bacterial genes that controls the production of the enzyme β-galactosidase. The somatostatin gene was placed in the middle of the β-galactosidase gene, where the two genes would be transcribed together under the control of the *lac* promotor gene. The resultant RNA was apparently translated into a hybrid protein from which the somatostatin could be chemically cut off.

How important, in general, is this technique? And specifically, how important is the artificial production of somatostatin? The main point about the technique is that it shows that it is possible to induce bacteria to make animal gene products. The demonstration that this can be done with synthetic genes may have two important consequences. First, there is mounting evidence that the genes of higher animals are different from those of bacteria in that they contain regions of DNA that do not code for the final protein. Since it is unlikely that a bacterium would be equipped to cope with such discontinuous genes, it is important to know that a simple coding sequence can be used instead of an actual gene. Second, there are now many cases in which what is needed for medical purposes is not the natural protein but a specific analogue of it. If bacteria can be made to produce the original from an artificial gene, then they can presumably also work on an artificial gene coding for an analogue.

There are also two important limitations on the technique, however. First, it is only practical to make synthetic genes for relatively small molecules, and small molecules are not very difficult to synthesise by traditional means. Whether genetic engineering will eventually prove the cheaper way it is hard to gauge. Second, the particular method Boyer's team used to clip the somatostatin out of the hybrid protein is not generally applicable. It depends on the fact that the bacterial protein contains a specific chemical group that is not present in somatostatin. However, it is present in most proteins.

Somatostatin itself is unlikely to be very widely used for clinical purposes. It inhibits the release of the hormones glucagon, thyrotrophin, prolactin, gastrin and insulin. Because of its inhibition of hormones that act against insulin, it has been clinically tried in cases of extreme insulin-resistant diabetes (less than 5% of diabetics). But because of its effects on other hormones, and the fact that it inhibits the aggregation of platelets and may thus predispose to haemorrhage, it is most unlikely to find more widespread application. Attempts have been made to find analogues with more specific action, but they have so far failed and it may be that all the diverse actions of the neurohormone depend on the same chemical feature.

At this stage, therefore, the remarkable achievement of Boyer and his collaborators remains an advance in principle rather than in practice.