

the light of competitive pressures from conventional television stations and cable television networks.

The commission is also expected to publish for comment a proposal for squeezing more domestic satellites into geosynchronous orbits, perhaps by reducing the separation of higher-frequency satellites from four to three degrees of longitude.

Such a change, says FCC, would allow the launch of an additional six satellites which had been promised to the commission, but which could not be authorized because of the shortage of available slots.

The launch of the 20 new satellites is likely to result in an increase from 160 to 612 in the number of satellite communications channels available by 1985. Each channel can transmit 1,000 telephone channels or a single television channel.

The new satellites will also create the first major challenge to the giant American Telephone and Telegraph Company (AT&T) in the field of long-distance communication. Two competing companies — General Telephone and Electronics Corporation and the Continental Telephone Corporation — are building their own satellites. AT&T, General Telephone, Southern Pacific Communications Corporation and Hughes Communications will each be constructing their systems for the first time, each having been given permission to build three satellites and launch two.

Local newspaper production could be revolutionized by plans that the Gannett Company is said to be developing for a national newspaper produced in Washington, but beamed to the presses of some of Gannett's 82 local newspapers.

Satellite transmission is already used by the *Wall Street Journal* to print seven editions simultaneously throughout the country. Although no official confirmation has been given of Gannett's plans, it is reported that the initial investment would be about \$100 million; some commentators have pointed out that setting up a single newspaper distributed throughout the country would provide Gannett with the opportunity to become a major voice in national affairs.

Comsat's plans for a satellite-based television network are included in a set of comments which the company has submitted to FCC as part of its preparations for the Region 2 Administrative Radio Conference of the International Telecommunications Union, due to be held in the summer of 1983.

Four satellites would be used to cover the United States, each covering a different time zone, with the most westerly satellite also broadcasting to Hawaii and Alaska. The service would be operated by Satellite Television Corporation, a newly-created subsidiary of Comsat. The market for direct-broadcast satellites is expected to be tested with the modification of two existing spacecraft designs. **David Dickson**

## Ariane development

### More trouble

Ground tests of the principal rocket motors of Ariane, putative launch vehicle of the European Space Agency (ESA), have shown brand-new oscillations in the burn — and set the test programme back by a second three months.

Ariane's first test launch in late 1979 reached the planned trajectory, but the second — in May 1980 — ended moments after lift-off with a high frequency oscillation and loss of pressure in one of the first stage engines. A look back at the data for the first launch showed the same oscillation, but at low amplitude; and a re-run of the data accumulated during ground tests showed the same fault.

In October this year, ESA announced that the oscillations (at 2,300 Hz) could be cured by improving tolerances in the manufacture of the injectors, devices like a watering-can rose that mix the fuel and oxidant. This hypothesis will be tested at the end of this month, when new high precision injectors are tried for the first time. Meanwhile a new oscillation has appeared — at 2,700 Hz — and this sets in even with injectors that previously showed no sign of the vibration. While the 2,300 Hz problem "can be regarded as rectified" says ESA hopefully, the 2,700 Hz oscillation "is the subject of thorough investigation and action which still needs some time to complete".

Burn oscillations (called "buzz" or "screaming") are the *bête noire* of liquid fuel engine design and can destroy the engine if they reach high amplitude. One solution is completely to redesign the injector; another is to set Helmholtz resonators, tuned to the critical frequency, into the side of the combustion chamber in such a way as to absorb the oscillation energy.

Solutions such as this, however, verge on complete redesign of the engine — but this may be necessary in the end. The engines were originally designed for the French sounding rocket Diamant (in which similar instabilities were met and solved), but they

were stretched to the limit to meet Ariane's specification of 61 tonnes-weight thrust. The next series of engines, for a bigger Ariane, is based on a different design.

So it is seriously being questioned whether Ariane can meet its first commercial commitments: to launch the French MARECS B and SERIO 2 marine communications and meteorological satellites (which would go up together) and Intelsat V F6. These satellites, and the ESA X-ray astronomy satellite EXOSAT, were originally due for launch in 1981.

For the moment, ESA hopes to have the third test launch in June 1981, and the fourth in the autumn, beginning the commercial series later in the year. If, however, as some fear, the Ariane engines are inherently "marginal", redesign and retesting could take at least a year, and lucrative launch contracts might be lost to American competition. The lead that Ariane appeared to be establishing over the space shuttle — beset by its own problems but now believed to be running smoothly — is narrowing fast. **Robert Walgate**

## Halley missions

### NASA to go?

#### Washington

Can the new US Administration be embarrassed into mounting a mission to Halley's comet when it passes through the Solar System in 1986? The proposal has already been passed to president-elect Ronald Reagan from scientists in his home state of California. They point out that the European Space Agency, the Soviet Union and Japan all have plans for separate Halley missions — and that for the United States not also to go would be a major blow to national prestige.

Revised plans for a Halley fly-by were developed earlier this year at the Jet Propulsion Laboratory (JPL) in Pasadena, run for the National Aeronautics and Space Administration (NASA) by the California Institute of Technology (Caltech). Following last year's rejection by the White House of a request for funds to develop an ion-drive — for which money

## Beyond Saturn

Saturn, as seen by Voyager 1 on 16 November, four days after the encounter. Some of the dark spoke-like ring features (*Nature* 4 December) are seen as bright patches due to scattering of sunlight from particles within them. Voyager 1 will be monitored to as great a distance as possible in an attempt to detect the boundary between interplanetary and interstellar space, where the "solar wind" becomes undetectable. Voyager 2 will reach Saturn on 25 August 1981, Uranus in 1986 and Neptune in 1989.



has since been allocated by Congress, but too little and too late — the revised mission would rely on a ballistic launch, limiting its ability to manoeuvre near the comet.

Many JPL scientists still think the mission would be worthwhile, a conclusion backed up by the mission's science committee, headed by Professor John Ververka of Cornell University. And the proposal has already been put to Mr Reagan by Caltech trustee Earle M. Jorgensen, a Los Angeles businessman and close friend of the president-elect.

Scientists at JPL are stressing the question of national pride, one aspect of the space programme that they feel has received relatively little support from the Carter White House. But other members of the space science community are worried that political support for a fly-by mission could prejudice funding for NASA's own favourite scientific project, the Venus Orbiting Imaging Radar (VOIR).

In an unusual move (considered by many a pre-election gambit to win Californian votes), the White House announced in October that it was planned to request funds from Congress for VOIR when the 1982 budget proposals are submitted in January — implying a rejection of the revised Halley plans.

From the scientific point of view, VOIR is reckoned to be more fruitful than the Halley intercept. Members of NASA's space science advisory committee have already stated that they find the possibility of losing VOIR and getting the Halley mission instead to be "extremely distressing".

In addition, however, to the financial attraction — the present Halley plans would make substantial use of instruments developed for the Voyager missions, and its total cost of \$250 million would therefore be only about half that of the proposed VOIR — JPL scientists point out that the chance to observe the comet is a "once in a lifetime opportunity".

Officials from the European Space Agency (ESA) are watching the new developments with some concern, since they feel that a NASA project might well overshadow the more modest goals of ESA's own Halley mission, Giotto, particularly since the latter may not be able to produce photographs of the comet comparable to NASA's.

A substantial NASA involvement in the European effort is now unlikely. Two weeks ago, ESA's space science committee decided to keep the launch a European affair, using the French Ariane rocket, and were therefore not interested in the US offer of using a Delta launcher in exchange for payload space.

US scientists will not be entirely excluded from the European mission. A number are listed as co-investigators in experiments submitted for inclusion in the spacecraft. And ESA is still negotiating terms for Giotto to make use of NASA's deep space tracking network.

NASA, however, is uncomfortable about accepting the unusual role of second fiddle, and supporters of a US mission are emphasizing this possibility in efforts to generate support. Adding the Halley mission to the 1982 budget for NASA would affirm to the world in a "spectacular and dramatic way" that US leadership in high technology stands unsurpassed at the frontiers of knowledge, according to a statement published in the *Congressional Record* by conservative Republican Senator Storm Thurmond. Another supporter is ex-astronaut Senator John Glenn.

If the mission is given the go-ahead, its planners will have a delicate balance to weigh up. Scientifically, more data will be obtained from intercepting the comet after it passes through its perihelion, since solar heating will stimulate the discharge of gas and dust particles. But politically an earlier intercept might be more attractive, as this would pre-empt both the European and the Soviet post-perihelion encounters.

Top NASA administrators are also said to be concerned about the risks of the mission — if the spacecraft is hit by a dust particle there might be no scientific return at all. Scientific and political priorities are therefore likely to meet head-on; nobody is predicting the outcome.

David Dickson

## Polish universities

### Union snag

The drafting commission for the new Bill on Higher Education in Poland met for the first time two weeks ago, under the chairmanship of Professor Zbigniew Redich. The commission was set up by the Minister of Science, Higher Education and Technology, Dr Janusz Gorski. A few days previously, Warsaw University students had staged a sit-in in one of the main buildings of the university to express their lack of confidence in the minister.

The two events are not unconnected; the new bill will give Polish universities considerably more autonomy and a more democratic form of self-government which will include student participation. The two hundred students who occupied a hall in the university's Kazimierzowski Palace were protesting, first and foremost, against the difficulties they are encountering in registering the new Independent Students' Union (NZS). Since students are not "employees", they cannot register as an independent trade union under the Gdansk accords. The first draft of the ministry's "instruction" permitting registration of NZS proved unacceptable to the Warsaw students, although it had been worked out with the participation of NZS delegates. When the ministry negotiator suspended talks with NZS, on the grounds that he must first consult the (now greatly depleted) Socialist Students' Union, NZS considered that the ministry had broken

off negotiations unilaterally and began their sit-in.

After occupying the hall for two days, the students won what they described as a partial concession only — a new ministry instruction on registration to come into force on 20 December. This should allay at least one fear — that without legal status, NZS would be unable to participate in the new "self-government" system of the university. Demands for a national NZS delegate meeting on student problems and for the publication of their grievances in the press were not met.

Neither the concessions by the minister nor the conciliation efforts of the university rector, Dr Henryk Samsonowicz could persuade the students to end their sit-in. Ironically, in view of the fact that NZS cannot legally be a trade union, it ended its protest only in response to a call for restraint issued by the Independent Trade Union Confederation Solidarity.

Vera Rich

## Fissile material

### Counting wrong

Are eleven kilogrammes of highly enriched uranium missing from Dounreay, the UK Atomic Energy Authority's (UKAEA) fast reactor research establishment in North Scotland? The authority cannot say. The amount appears in this year's tally of "materials unaccounted for" (MUF), and is something of an embarrassment. According to the UKAEA, the quantity is within measurement errors on a large throughput, but the throughput cannot be revealed for security reasons and the errors have not been calculated. So it is difficult to give significance to the figure.

All MUF figures announced last week lack error estimates because, an official said on Monday, "errors would have to be combined from many completely different processes and sources".

Nevertheless the 11 kg "loss" at Dounreay was near enough to a critical mass to give the authority pause. In the first three years for which MUF figures were announced, the MUFs at Dounreay for highly enriched uranium were +2.8 kg, +3.7 kg, and +0.3 kg, all indicating paper gains of the material. However, Dounreay was not reprocessing fuel for much of that period, and the present figures relate to the first year (since MUF accounting began) when fuel from the now closed Dounreay fast reactor was being reprocessed.

The figure amounts to a difference between the quantity of  $^{235}\text{U}$  estimated to be on the site at the beginning of the year and the quantity estimated at the end, taking into account traffic on and off site. But much of the  $^{235}\text{U}$  at the beginning was in the form of irradiated fuel rods, and so inaccessible to measurement. The amount in the rods was estimated using knowledge of their position and operating time in the