

quency of the laser. The beam is passed through methane gas and locked to the methane absorption line; another laser, using the same kind of absorption gas will then operate at the same frequency.

The improved frequency control made possible by this technique may open up new frequencies for telecommunications—perhaps even a thousand-fold increase over the number of frequency bands at present used for telecommunications. Another possible spin-off is that improved frequency control of tuned lasers will help the nascent science of monitoring atmospheric pollutants by lasers.

The accuracy of the determination also opens up the possibility of eliminating the need for a separate length standard. By defining the speed of light as  $299,792,456.2 \text{ km s}^{-1}$ , the length of a standard meter could be determined in terms of frequency. But to define absolutely the speed of light would require international acceptance.

## ATOMIC ENERGY COMMISSION

### Environmental Review

by our Washington Correspondent

THE Atomic Energy Commission has a tricky procedural question on its hands. Should the environmental review of individual power stations include the environmental effects associated with producing and fabricating the uranium fuel, reprocessing the spent fuel rods and getting rid of the radioactive wastes? Or should the fuel cycle be treated separately?

In several licensing hearings, participants have argued that the environmental statement should include an analysis of the costs associated with the uranium fuel cycle, but the Atomic Safety and Licensing Appeal Board has held that only the environmental effects associated with transporting fuel from the manufacturer to the reactor and irradiated fuels from the reactor to the reprocessing plant should be considered. The AEC has now, however, decided to hold public hearings on the question starting on February 1, 1973. The commission has also published for comment a survey of the environmental costs associated with the fuel cycle for a model light water plant producing 1,000 MWe. (Available from the Deputy Director for Fuels and Materials, Directorate of Licensing, US Atomic Energy Commission, Washington DC 20545.)

In general, the survey comes to the conclusion that the environmental costs associated with the fuel cycle for such a plant are so small that they would not significantly affect the conclusions from a cost benefit analysis for individual plants. Land use for the fuel cycle of a 1,000 MWe power plant is found to be less than 10 per cent of that required

to provide fuel for an equivalent coal-fired station, water usage for the fuel cycle is found to be less than 4 per cent of the total required to operate the plant itself, and the electrical requirements of the fuel cycle are reckoned to be less than 5 per cent of the energy produced by the reactor per year. As for effluents, the AEC suggests that perhaps the chief environmental impact may come from the emission of fluorine from the enrichment process, but the output of fluorine from the fuel cycles of 140 light water reactors would only amount to 0.2 per cent of the output of fluorine from other industries in 1980, the survey suggests.

As for radiological effluents, the most significant release is Krypton-85 from fuel reprocessing. The survey suggests that the annual radiation doses to an individual at the boundary of a reprocessing plant would amount to about 0.8 mrem to the whole body, 1.0 mrem to the bone, 15.5 mrem to the thyroid and 14 mrem to the outer layer of skin. The thyroid dose is about 1 per cent of the guideline limits recommended by the International Commission on Radiological Protection.

The survey makes no recommendations, but the implication is that the AEC considers that the environmental effects associated with the fuel cycle are so small that they need not be considered in individual applications. On the other hand, however, the survey gives no reasons why all the environmental costs of the operation of a power plant should not be considered in the environmental review.

## UPPER ATMOSPHERE

### German Satellite

by our Washington Correspondent

A GERMAN scientific satellite, AEROS, will be launched next week by NASA from the Western Test Range in California. Designed to study the upper atmosphere, the satellite will be placed into a polar orbit with an apogee of 800 km and a perigee which will be as low as 230 km. This highly eccentric orbit will allow the spacecraft to dip into the upper atmosphere to sample the chemical and electrical composition of the upper atmosphere and the F region of the ionosphere.

A cooperative project between NASA and the Bundesministerium für Bildung und Wissenschaft (BMBW) of the Federal Republic of Germany, AEROS will carry five experiments—four German and one developed at the Goddard Space Flight Center. The four German experiments are a mass spectrometer to study the chemical composition of the ambient atmosphere and ionosphere, an experiment to determine the electron density distribution and ion tempera-

ture, an impedance probe to measure electron density and an extreme ultraviolet spectrometer to measure the intensity of the solar radiation. The US experiment will measure the temperature and the overall density of the neutral ambient atmosphere. One objective of the mission will be to correlate the data on the ionosphere and ambient atmosphere with the observations of the solar radiation, which ionizes the upper atmosphere.

Air friction in the upper atmosphere will gradually lower the perigee and apogee so that after about 130 days, the perigee is expected to decrease to about 220 km and apogee to about 580 km. Small hydrazine engines on the spacecraft can then be fired to increase the apogee and extend the life of the spacecraft. The atmospheric density at perigee will also be calculated from the orbital decay, by measuring the rate of change of the orbital period.

## Short Notes

### Space Tug

THE National Aeronautics and Space Administration has asked for proposals from the aerospace industry on the study of space tug systems. The tug would provide additional propulsion for payloads launched by the shuttle. NASA is asking for proposals for three study contracts, each worth \$750,000, two of which would examine the feasibility of a tug fuelled by liquid hydrogen and liquid oxygen, and the other would study a tug using storable propellants. The tug would be fuelled on the ground, launched by the shuttle in low earth orbit, recaptured by the shuttle and returned to Earth for repeated use.

### Weizmann Institute

THE Weizmann Institute of Science in Rehovot, Israel, will get a share of the National Cancer Institute's budget for cancer research. It was announced last week that the NCI has awarded a contract worth \$447,000 to the Weizmann Institute to set up a multi-disciplinary cancer research programme. Part of the money will go to Dr Michael Feldman for a study of the effects of both thymus-derived and bone-marrow-derived lymphocytes on the growth of cancers in experimental animals. Dr Leo Sachs will receive money for the study of mechanisms for controlling the growth of mouse leukemia cells, Dr Michael Sela will work on the role of antigens as a means of detecting cancer, and the remainder of the money will be spent on a study directed by Dr Nathan Trainin which will also be concerned with the effects of lymphocytes from the thymus on the growth of cancer cells.