say, academic life, but that it would be in the long-term interest of those working as professional people within the Civil Service that something should be done to remove the barriers between the professional and administrative career tracks.

Although the Fulton Commission in 1968, in the course of its attack on the generalist as senior Civil Servant, advocated more administrative responsibility for professional civil servants, many scientists in the service are bitterly disappointed that so little has been done to implement these recommendations.

US science budget

Stability ahead?

Washington

Locked once again into the annual congressional switchback over research funds, science policy administrators in Washington have eagerly endorsed plans to place key aspects of the congressional budget review process on a multi-year basis. On 21 July, the House of Representatives passed a bill submitted by its Science and Technology Committee that would require the Administration to provide two-year (or longer) estimates of major research and development expenditures as part of its annual budget request to Congress.

The objective is that any authorization committee should then be able, if it so chose, to approve research programmes for two or more years. At present, most research spending has to be authorized annually (except for the National Institutes of Health, for which new authorizing legislation is now under consideration (*Nature*, 22 May)).

Multi-year authorizations would affect only part of the budget process. Decisions on appropriations (authority to spend) are usually more significant and these would continue to be decided annually. Even so, supporters of the new legislation hope that, if a companion bill can be coaxed from the Senate, the result will be a first step towards greater stability and continuity for research funding. Some even see it as a "pilot endeavour" for multi-year funding of federal programmes in general.

The idea appeals equally to Congress, to the Administration and to leaders of the research community. In the first place, it would cut down considerably on the amount of time and effort now required of all parties.

But as Dr Frank Press, director of the Office of Science and Technology Policy (OSTP), told a recent hearing on the bill, "by its nature, most research and development has to be carried out over a lengthy time-frame".

Some hope that the reduced commitment would provide more time for more detailed examination of specific policy proposals, and that multi-year authorization would help to improve the climate for long-range planning of research, a goal

that frequently conflicts with the need to respond to fluctuating political demands. The result should be, according to the bill's supporters, that research and development expenditure is less vulnerable to short-term changes in the fiscal climate. As things are, research and development suffers because, although it is a relatively small proportion of the overall federal budget, it represents almost a quarter of that which is not predetermined by specific laws, those concerned with social security for example. Extending the timescale of federal planning for research happens also to accord with "the budgetary philosophy of this Administration", according to Mr Bowman Cutter, executive associate director of the Office of Management and Budget (OMB).

In practice, however, multi-year planning will be difficult; the Office of Technology Assessment has told the committee that simple and flexible methods will be needed for treating inflation for example. Inflation affects research and development differently from other part of the federal budget; Dr Press has told the committee that many areas of science suffer from the "natural" built-in inflation that comes about because research becomes more sophisticated and the equipment and technical support required correspondingly more costly.

The House committee has taken Press's point. The legislation now passed by the House would require OSTP to assist and advise OMB on the evaluation of the effects of inflation factors on research and development and to suggest how they should be allowed for.

Most of this is relatively uncontroversial. Less so are proposed changes in the reporting requirements which existing legislation imposes on the OSTP and the National Science Foundation (NSF) to keep Congress up to date with the direction and intentions of official research and development policy. In particular, the new bill would dispense with OSTP's annual report to Congress on the nation's research and development. Instead, the NSF would

be required to produce a broad outlook every four years with revisions every two years. OSTP officials make little secret of their scepticism about the usefulness of such reports, hitherto required by the Presidential Science and Technology Advisory Organization Act of 1976, and the House Science Committee now appears to agree.

Some members of Congress, however, feel strongly that OSTP should be making public policy statements about the general health of research and development and the directions that it should be taking. They are thus unhappy about OSTP's apparent abdication of responsibility for long-range planning which, they claim, is explicitly required by its legislative mandate. Mr George Brown, a member of the House committee, in a minority report on the new bill, says OSTP has brought upon itself the difficulties it has encountered in preparing the reports required by law. There is reason to believe that the General Accounting Office is about to issue a report that is severely critical of OSTP on the same grounds.

David Dickson

India in space

One up so far

India has taken another step into the space age. Last week, the second test flight of the 17-tonne SLV-3 launcher successfully placed a small satellite into near-Earth orbit, making India one of a select group of countries with independent satellite launch facilities. SLV-3's first test flight last year ended in disaster when the rocket fell into the Indian Ocean 15 minutes after lift-off from the Sriharikota launch pad off India's east coast.

Mrs Gandhi's announcement that the second test flight was a success came during a debate in the Indian lower house (Lok Sabha) on defence ministry grants, leading some observers to speculate that the main impetus behind the rocket's development is military. India has never denied that its expertise in space technology could be used to launch reconnaissance satellites or develop intercontinental ballistic missiles, but it has always stressed that its space programme is intended to be peaceful and geared towards national development.

Space applications, such as remote sensing and telecommunications, form the major part of India's space programme. India has cooperated for several years with other countries such as the Soviet Union, France and the United States on remote sensing and telecommunications, one notable example being the SITE experiment with the US to bring educational television programmes to rural areas.

Rohini 1, the 40-kg satellite launched last week to record the flight characteristics of SLV-3 is the third Indian satellite to go into orbit. The Soviet Union launched the two others: Aryabhata, a scientific satellite, in 1975 and Bhaskara, for Earth observation,

US unemployment

Note: Unemployment rates are averages for the year
SOURCES: Bureau of Labor Statistics and National Science Foundation

India: where next?

in 1979. Plans for further satellites include two more in the Rohini series. These will be larger than Rohini 1 and geared to specific scientific or applications tasks. India is also planning to launch an experimental telecommunications satellite, APPLE, on the third test flight of Ariane, the European launcher, next year.

The present SLV-3 rocket, based on NASA's Scout launcher, is too small, however, to launch some of the large satellites planned. Large liquid rocket motors are already being developed at the Vikram Sarabhai Space Centre on India's west coast for incorporation into future rockets capable of putting up to 800 kg into geosynchronous orbit.

The current launcher programme, which began in 1973, grew out of earlier experience gained in building sounding rockets at the Thumba equatorial rocket launching station.

Judy Redfearn

Nuclear explosions

No alarm

Washington

When can a cloud of dust particles resemble a nuclear explosion? When it is detected by a nuclear monitoring satellite, according to a report published last week by the US Office of Science and Technology Policy.

Spurred by speculation over the nature of a mysterious explosion apparently observed by a military Vela satellite over the lower Atlantic ocean last September, OSTP set up a panel of inquiry chaired by Dr Jack Ruina of the Massachusetts Institute of Technology.

The panel was at first inclined to agree with defence officials who claimed that the satellite had detected a clandestine nuclear explosion carried out by the South African Navy either on its own initiative or in collaboration with Israel.

After intense scrutiny of the data from the satellite, however, the panel now says that the flash of light seen by the satellite was "probably not" a nuclear explosion. Its alternative hypothesis is that the satellite was hit by a small meteoroid, possibly as small as a speck of dust, and that this dislodged paint chips or other particles from the satellite's surface, which subsequently reflected sunlight into its detectors.

In support of this hypothesis, the scientists cite discrepancies in the data from the satellite's two sensors, indicating that the source may have been considerably closer to one sensor than the other.

In addition, there was a lack of any other evidence detected by stations on the ground — such as increased radiation or seismic activity — which would have corroborated the explosion hypothesis. Nor were there intelligence reports that a nuclear test had been carried out by either country. The Defense Intelligence Agency is not convinced. Before the OSTP report was released, the DIA leaked to the press its own conviction that a nuclear explosion had indeed been detected by the satellite, and that it had been carried out under weather conditions chosen to make detection difficult.

The White House, however, has adopted as its official position the OSTP panel's conclusion that there is insufficient evidence to prove a clandestine weapons test. According to State Department officials, this is the view that will prevail when a report on the incident is made to the Nuclear Non-Proliferation Treaty review meeting in Geneva next month.

David Dickson

Nuclear power

Ore running out?

The year just past was "another year of lost opportunities" according to the Nuclear Energy Agency (NEA), the OECD's own organization for the promotion of civil nuclear power. In its most recent annual report (the Eighth Activity Report covering 1979), the agency says that the growth of nuclear energy production in 1979 was a disappointing 2.2 per cent, compared with the average growth rate of 27.5 per cent a year during the period 1968-78. The pace of growth has paradoxically declined since the oil price rises of 1973.

On the face of things, however, the figures are not too bad. According to the report, there were 232 civil nuclear plants in operation at the end of 1979, and a further 229 under construction or on order, only seven more than in the previous year. New orders were almost offset by cancellation in West Germany, Spain and the United

States.

Whatever happens to new orders, the output of nuclear electricity in the OECD area in 1990 is now almost certain to be between 33 per cent and 40 per cent of the energy equivalent of oil imports in that year, according to figures quoted in the report. The hiatus in the projected growth of the nuclear industry in 1979 is attributed to the international concern with nuclear proliferation, the Three Mile Island accident, uncertainty about waste disposal and "the related problems of public understanding".

On the consequences of the Three Mile Island accident, the NEA follows a judicious line. Its report says that the accident showed that nuclear power is not accident-free, that defence in depth can work in practice but also that the accident "has revealed a number of deficiencies in the way that reactor safety has been approached up to now". It urges that more attention should be paid to the malfunctioning of other than major items of equipment, and promises to do what it can to help.

One consequence of last year's hesitation about nuclear power is, according to NEA, that the uranium mining industry has become overcautious, thus threatening future growth.

World uranium reserves at costs up to \$80/kg of uranium metal (the present economic limit on production) have increased by some 200,000 tonnes in the past two years, and now total 1.85 million tonnes. The increase came mainly from discoveries in Brazil and Canada and "improved knowledge" of deposits in Namibia, South Africa, Spain and the United States. NEA estimates that these reserves match the needs of Western nuclear power programmes between now and 2000-2005 but also considers that a significant portion of ore now identified will not be recovered "for technical or political reasons". So, the argument goes, there is an "urgent need" for the discovery of additional resources, reinforced by the wide range of the projections for nuclear power in 2025. The cumulative uranium requirements by that date range from 3.4 to 12 million tonnes, depending on nuclear power growth, the extent of reprocessing and the degree of development of fast breeders.

The NEA also looks forward to the exploitation of leaner ores, capable of yielding uranium at a cost of \$130/kg¹. Its upper estimate of the quantity of uranium in reserves now identified, not all of them explored, is put at 5.04 million tonnes, a quantity comparable with the estimated need of the nuclear industry by the second decade of the next century unless breeder technology is applied rapidly. Thus, the report concludes, the viability of the industry at the turn of the century will depend on the success of exploration in the coming ten years.

Robert Walgate