

USA

Battling against the inevitable

Years of hitherto unsuccessful effort in the US Congress have culminated in a bill providing for an increase in research on earthquakes. Chris Sherwell reports from Washington

DEVELOPMENTS now reaching a climax in Washington may not do for earthquake research what previous much-publicised efforts did for space and cancer research, but the comparison may not be entirely inappropriate. The fanfares may be absent and the vistas uncertain, but an agreed commitment in principle which also has legislative form now promises a long-awaited boost for work in an exciting area and marks an important move from disaster relief to disaster prevention.

The latest step along the tortuous path to a comprehensive coordinated programme to reduce the hazards posed by earthquakes came last week when the House of Representatives approved by a margin of 229 votes to 125 an authorisation bill on which two House committees had reported. The bill was due to go back to the Senate late last week for consideration of the minor differences from the Senate version

passed earlier this year, and was expected to find its way to President Carter's desk for signature shortly thereafter.

The bill, which when enacted will be known as the Earthquake Hazards Reduction Act of 1977, is designed to reduce the risks to life and property of future earthquakes in the United States. The logic underlying it is simple: earthquakes are inevitable, and population increases and urbanisation enhance the dangers they pose. To minimise both the risks and potential losses, a coordinated programme to increase research and to help apply its findings and generally improve the readiness of vulnerable areas for emergencies is necessary. The bill creates a \$215-million three-year federal programme to do just that.

Though expenditure is scheduled to begin at the start of the coming financial year (fiscal year 1978) beginning on 1 October, the money must still be appropriated in a separate process. In the meantime the agencies slated to use it must rely on appropriations already granted them for that period. The two major agencies involved—the National Science Foundation (NSF) and the US Geological

Survey (USGS)—expect to feel the improvement over recent years quite soon, however, because the appropriations already granted are based largely on the same formulation used in drawing up the bill.

That formulation was contained in a report of a joint advisory committee chaired by Dr Nathan Newmark and published a year ago. Entitled *Earthquake Prediction and Hazard Mitigation: Options for USGS and NSF programs*, the report outlined low, intermediate and high levels of support for earthquake research, all of which were higher than funding levels in past years. The intermediate level, which President Ford used in his proposed budget for fiscal year 1978 and which President Carter retained in his revisions, provided for expenditure of nearly \$54 million, an increase from \$22½ million the previous year. This was split approximately 52 : 48 between NSF and USGS (in favour of NSF). Under the bill passed by the House, some \$55 million would be split 50 : 50.

Going by the breakdowns given in the Newmark Report, the two agencies would each spend about 10% of their 1978 allocations on fundamental studies of the causes and mechanisms of earthquakes. NSF does not expect to see any great difference in this area, but on the engineering front, which

No long encounter with Halley's Comet

THE National Aeronautics and Space Administration (NASA) has reluctantly abandoned an ambitious and expensive plan to conduct a close-range study of Halley's Comet as it swings around the Sun in 1986. The plan would have entailed launching a spacecraft in 1982 on a complicated journey, culminating in an extended rendezvous with the comet three and a half years later.

According to NASA officials, development of the spacecraft together with a new propulsion system to manoeuvre it into Halley's orbit would have cost \$500–600 million. In particular, considerable outlays would have been needed in the next two years to make the 1982 launch date, and NASA simply doesn't have enough money in its budget.

Consequently, the agency has been forced to drop the idea of paying an extensive visit to Halley's Comet, and it is now looking into less expensive plans to launch a spacecraft to make a brief encounter with the comet soon after it emerges from behind the Sun. In addition, NASA is con-

sidering the possibility of developing a spacecraft to make a lengthy visit to the comet Encke in 1987.

The decision to forego the chance of a long encounter with Halley's Comet will be a major disappointment to many space scientists. Comets have recently come under serious study because they may provide some clues to the origins of the universe. According to one widely-held theory, they are like giant dusty snowballs, made of condensed matter from outside the solar system. As they swing past the sun, heat vaporises material from the comet's nucleus, which then forms the so-called tail.

A trip to Halley's Comet, culminating in an extensive visit, would have been a difficult proposition, however. The chief problem is that the comet orbits the Sun every 76 years in the opposite direction from the Earth, and a complicated series of manoeuvres would be required to bring a spacecraft to the same path and speed as the comet.

For the past year, NASA has been looking into two propulsion systems

which could provide the required manoeuvres. The first, a so-called solar sail, would have consisted of an immense plastic sheet, deployed from the spacecraft on booms, which would act like a sail in the solar photon stream. The second idea, an ion drive system, would involve the ionisation of mercury vapour, which would then stream out of the back of the spacecraft to provide thrust. Last week, NASA announced that it has chosen the ion drive system which will be developed for a possible mission to visit Encke in 1987 and which will also be used to power future interplanetary probes.

Though the plan to rendezvous with Halley's comet has been abandoned, NASA may still launch a spacecraft in 1985 to fly close to the comet and pass through its tail. Such a mission would not require a special propulsion system because complicated manoeuvres will not be required to match orbits. It would consequently be much cheaper, but the scientific benefits would also be much less.

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would take some 60% of the NSF allocation, research funding will almost double in the coming year. This effort will focus on the design, planning, construction and use of various man-made works to resist earthquakes. Another 20% of NSF funds would probably go to related socio-economic and policy areas.

On the same basis, USGS is likely to devote about half its allocation to the development of methods to predict the time, place and magnitude of future earthquakes. Another 35% or so would go on assessing earthquake hazards, while a small amount would be spent on studies of artificial earthquake induction.

As for fiscal years 1979 and 1980, the 50:50 split between the two agencies would continue for budgets totalling \$70 million and \$80 million; the breakdown could be expected to follow broadly the same pattern. If the patterns of spending are predictable, however, the scientific results are not. Recent scientific progress in the field has probably assisted the bill's passage; reliable earthquake prediction seems more likely than ever before.

Of equal importance for the bill, however—apart from an unsubstantiated sense that more earthquakes than usual have struck in recent years—was the support given by the Carter Administration, notably by the Office of Science and Technology Policy in the White House, which is headed by the President's science adviser, Frank Press, himself a geophysicist. Indeed, the bill reflects many of the Administration's preferences. When it came out of the House Interior and Insular Affairs Committee, under which USGS falls, the important difference from the bill it received from the House Science and Technology Committee, and which put it in line with the Senate version, was that it contained no specific institutional proposals. The bill it received had suggested an Office of Earthquake Hazards Reduction, a National Advisory Committee, and an Earthquake Prediction Evaluation Board.

Given the President's desire for flexibility while pursuing plans for government re-organisation, these suggestions were premature. Accommodatingly, the bill thus provides simply for designation of a "lead agency", and the usual establishment by the President of roles and goals.

On Capitol Hill not all reactions

Controlling technology flow

QUESTION: how does a technologically and militarily sophisticated superpower, which is committed to free trade principles, contain the contribution that its much sought-after exports might make to the military capability of potential adversaries? **Answer:** it's a problem. The latest round in a recurring debate in the United States on the matter came immediately before the Labor Day weekend at the end of August, when the Secretary for Defense, Harold Brown suddenly released a five-page memorandum sent to various officials in defence-related agencies.

Cast as an interim policy statement on controls over the export of US technology, the memorandum draws on the recommendations from the Defense Science Board Task Force, published last year as the so-called Bucy Report (see *Nature*, 15 April 1976). This indicated that controls over the flow of strategic or "critical" technology to Communist countries had broken down in recent years, and suggested that the United States should refine the list of relevant technologies and apply sanctions where they were unwarrantedly passed on, directly or otherwise.

The "interim internal guidance" which the Brown memorandum provides for the Department of Defense (DOD) covers exports both to allies and to potential adversaries. It says DOD will support the transfer of critical technology to countries with which the US has a major security interest where this can strengthen collective security, contribute to NATO standardisation and enhance the return on R&D. But with both allies and other non-Communist countries, DOD will also assess the recipient's "intent and ability to prevent either the compromise or the unauthorised re-export of that technology", relying on the intelligence and security communities to help discover any breaches. Violations would result in sanctions.

Regarding exports to potential adversaries, a "presumption for recommending disapproval" will operate where these involve a revolutionary advance in defence-related technology. But where they involve end

products not of strategic importance or with virtually unextractable valuable technology, DOD will normally recommend approval. Either way, the key consideration would be the recipient's military capability.

According to the memorandum, the Department of Defense will be asking the Commerce Department to change present regulations so that exports of critical technology to all countries would require a valid licence; DOD will also recommend a streamlining of application procedures to minimise delays. In addition, DOD will suggest that the State Department negotiate new measures to control the flow of technology to Communist countries with the Consultative Group Coordinating Committee (COCOM), which is a group of NATO countries and Japan.

The primary objective in all this, of course, is to protect US lead times in the application of technology to military capabilities. The hope is that this will be more readily achieved through an emphasis on technology rather than end products, and by having the policy cover all countries using faster procedures. The provision allowing for DOD "recommendation" will help here; so too will the plan to maintain a continuously updated list of critical technologies. No indication was available, however, regarding the timetable for a fully national policy; that will bring in other government departments.

In the meantime, one minor worry remains. A covering letter to the Bucy Report described, as potentially an "area of concern", the scientific exchange agreements under which scientists move between the USA and the Soviet Union. The Brown memorandum does not take this matter up in any real detail, but says that when the potential for "inadvertent transfer" is high, DOD will recommend restrictions "on the amount, extent or kind of interpersonal exchange". Such exchanges are already subject to certain procedures and regulations, however, and the Head of the Exchanges Office at the State Department says the memorandum implies no changes.

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Colin Norman leaves Nature this week to go to the Worldwatch Institute in Washington. He has been our Washington correspondent for about six years, having previously worked in the London office. With his departure the journal loses a distinguished observer of the scientific scene.

were positive. Senator Alan Cranston of California, who has sought earthquake legislation for five years, naturally welcomed passage of the bill as a "historic step"; last year he saw his own bill, already passed by the Senate, die in the House at the end of

the session. But in the House a Maryland Republican was more caustic: a Congress which could not detect an inflationary impact in spending a quarter of a billion dollars, he suggested, "could not possibly detect an earthquake". □