Gramm-Rudman cuts R&D by $2.5 billion

On March 1, the first automatic federal spending cuts go into effect under the Balanced Budget and Emergency Deficit Control Act (known for its Senate authors, Gramm, Rudman and Hollings). Of the $11.7 billion slated to be cut from the overall 1986 budget, an estimated $2.5 billion is to come from research and development (R&D) programs – primarily within the Department of Defense. Ironically, these cuts come less than a month after President Reagan unveiled his blueprint for next year's spending – one that proposes significant increases for R&D, especially in programs funded by DOD.

Under this new law, passed on Dec. 12, mandated budget cuts must be implemented whenever federal spending for that year will cause the federal deficit to exceed a specified level. The deficit ceiling allowed for the current, fiscal year '86 budget is $171.9 billion. However, regardless of how much this year's budget exceeds its FY '86 deficit ceiling, the law limits cuts beginning March 1 to $11.7 billion. DOD will suffer the largest percentage cuts under the new law – 4.9 percent, versus the 4.3 percent asked of all other agencies. Because of the overall size of its budget, it will be shouldering 67 percent of the R&D cuts.

On Jan. 15, the Congressional Budget Office and White House Office of Management and Budget (OMB) delivered their forecasts of the FY'86 deficit to the General Accounting Office, together with their estimates of the across-the-board spending cuts – called sequestrations – that would be required to comply with the Gramm-Rudman-Hollings (GRH) law. Based on those reports, the General Accounting Office passed on to the President its recommendation of how much would have to be cut. On Feb. 1, Reagan issued the sequestration order that goes into effect next week.

Researchers funded by the federal government "haven't been told how these cuts are going to be made," says Rick Jerue, vice president for legislative and government affairs with the Washington, D.C.-based American Association of State Colleges and Universities. And asking questions doesn't help. "What's so frustrating about GRH," he told SCIENCE NEWS, "is that every time you ask a question, the answer is 'I don't know.' " Part of the problem, he says, is that "the bill was put together at the last moment, without first holding any [of the usual] congressional hearings on it." He says that even the intent of its authors, normally used in determining how a bill will be implemented, "was never really clear."

Kevin O'Connor of the Federation of American Societies for Experimental Biology in Bethesda, Md., suggests another reason why some researchers – particularly those funded by the National Institutes of Health – have not voiced more objection to the March 1 cuts: "No matter how bad the cuts are in 1986, they pale against what will happen in FY '87."

Also contributing to some complacency over this round of cuts, Jerue says, is a court ruling, handed down by a three-judge panel on Feb. 7, which found a key provision of the law unconstitutional. Many researchers are banking on the expectation that these cuts ultimately will be struck down, Jerue believes.

In the law as it's written, the Comptroller General, who heads the General Accounting Office, ultimately decides where the cuts should come, based on the analyses sent him by OMB and the Congressional Budget Office. Explains Barbara Clay of OMB: "That's the final word on it. The President is obliged to take the Comptroller General's recommendations and make them law." But the three-judge court ruled that it was unconstitutional for the Comptroller General, as an officer of the Congress, to perform an executive-branch function.

This week the Supreme Court agreed to take up the case. Hearing arguments in April, the court is expected to hand down a quick ruling by early July. But even if it agrees with the lower court, this week's sequestrations are hardly moot, Clay points out. The GRH law states that until all legal challenges are resolved, its provisions – including cuts – must be implemented. And there's nothing in the law that says money sequestered during that period must be reallocated, she notes. Clay says her agency is hoping that if the Supreme Court affirms the lower court ruling, it will also offer some guidance on what to do with withheld funds.

– J. Raloff

FY 1986 R&D Obligations (in $ millions)

Agency	Before GRH*	After GRH	$ change after GRH*
Defense (military programs)	35,210	33,485	−1,725
National Institutes of Health	5,125	4,905	−220
Energy	5,000	4,785	−215
NASA	3,755	3,594	−161
National Science Foundation	1,394	1,334	−60
Agriculture	963	922	−41
Commerce	397	380	−17
Environmental Protection Agency	349	334	−15
All others	2,388	2,285	−103
Total	**54,581**	**52,024**	**−2,557**

*Computed from OMB budget data ("After GRH" figures) and percent reductions due each agency

Gauging the Aharonov-Bohm effect

Now seems to be the season for the experimental realization of paradoxical quantum mechanical effects (SN: 2/1/86, p. 70; 2/8/86, p. 87). This week it's the Aharonov-Bohm effect, in which a magnetic field alters the behavior of electrons without touching them. In the Feb. 24 PHYSICAL REVIEW LETTERS, Akira Tonomura and six colleagues working in the laboratories of Hitachi Ltd. in Tokyo report what they describe as the definitive experiment.

In 1959 Yakir Aharonov of the University of South Carolina-Columbia and David Bohm of Birkbeck College of the University of London, England, predicted that if two beams of electrons passed on either side of a space in which a magnetic field was present, the phase of the quantum mechanical waves belonging to one of the beams would be retarded with respect to the phase of the other, *even though* the field did not penetrate the space in which the electrons moved and the electron waves did not touch the field. "Such an effect is inconceivable in classical physics . . . ," Tonomura and co-workers point out. One possible interpretation of the effect is that it is an "action at a distance," in which one thing affects another thing without any physical contact.

To demonstrate the effect, experimenters must thoroughly shield the magnetic field. Since 1959 several experiments, including one reported by Tonomura's group in 1982, have purported to show the Aharonov-Bohm effect, but they have been severely criticized on grounds that magnetic field might be leaking into the space traversed by the electrons. Tonomura and co-workers assert that this time they have done all possible to satisfy the critics, and their result is ironclad – or rather, niobium- and copper-clad.

They made a ring-shaped magnet out of nickel-iron Permalloy coated with niobium. At temperatures near absolute zero, niobium is a superconductor and therefore expels magnetic fields that try to penetrate it. Laying it all around the magnet forces the magnetic field to remain effectively inside the magnet itself. Outside the niobium shield they put a copper shield. Copper prevents the elec-