REVIEW SYSTEMS

Computerized grants project is unveiled

Bethesda, Maryland

The halls of the National Institutes of Health (NIH) are paved with grant applications. So are the offices. Come deadline day, when 35,000 applications come in at the last minute, the Federal Express trucks are grid-locked in the parking lot unloading funding appeals. By the time NIH finish making 75 copies of each application and distributing them to all the appropriate offices, the agency is buried under more than 2.5 million applications, each about a hundred pages long — over a thousand tonnes of paper.

In the electronic age, this flood of paper is an embarrassing thorn in the side of the NIH and other US science agencies. Years of vague proposals to computerize the process have produced some abortive trials, several committees and plenty of excuses.

But now, a handful of computer evangelists with some hot machines are finally making progress towards the grail of grant-making: the all-electronic application and review. No paper, no post — nothing but bits and bytes.

Earlier this month, grants officials unveiled their plans for an electronic future at a meeting of the Division of Research Grants advisory board attended by senior NIH staff. Experimental grant software is nearing completion, they said, and will be tested in preliminary trials in early fall at the University of South Carolina, the University of Washington and another, yet unnamed, university.

In addition, a collaboration with the National Science Foundation (NSF) is aiming at a common applications form and software that could be used at both science agencies. The two combined receive some 70 per cent of all grant applications to the federal government.

Researchers are making progress towards the grail of grant-making: the all-electronic application and review. No paper, no post — nothing but bits and bytes.

John Mathis is the motive force behind the most ambitious of the NIH projects — one that will eventually not only allow scientists to create and submit their proposals electronically, but will also let NIH computers read and categorize them without human help. Mathis's vision of a computerized grant-making machine is a mix of simple personal-computer software and complex artificial-intelligence (AI) programs.

Known as the EGAD (Electronic Application and Grant) project, the effort is about to show its first face — a software program for distribution to universities that will check applications for completeness and accuracy in real time as a researcher enters the information.

The software (designed for Macintosh or IBM-compatible computers) will make sure that the numbers add up at the bottom of the financial portion, and that the researcher has not accidentally given something like 'biology department' as his or her last name.

Typing time and labour are just the most obvious of the savings. Mathis hopes that a sophisticated AI program that is still under design will also take over the tedious chore of assigning applications to the appropriate NIH institute and study section, a task that now requires a panel of in-house scientists.

The AI program, known as 'the referral assistant', will scan an application, looking for information that reveals its scientific field and subject. Several techniques for doing this are being considered, including keyword searches and citation analysis, which would use the references cited at the end of the application as a guide to the science within.

At the National Science Foundation, however, progress on an electronic grants package has been tempered by a sobering example of how hard the transition can be.

In 1988, NSF started a project known as EXPRES to produce a program that would allow scientists to create and submit grant data electronically. Two universities, Carnegie Mellon and the University of Michigan, were to develop a standard 'document

Electronic review: mixed messages

Washington

Science agencies may save a lot of paper-shuffling by receiving grant applications electronically, but the real delay and expense is still the review process after the applications arrive. Both the National Institutes of Health (NIH) and the National Science Foundation (NSF) fly hundreds of researchers to Washington each year to staff panels that review stacks of applications, ranking them in order of scientific interest. The entire review process costs the two agencies some $80 million each year, and can take up to nine months to complete.

Both agencies are considering replacing the traditional face-to-face review group with their electronic equivalents. But as a few trial projects have shown, getting scientists to give their full attention to peer review while sitting in their own offices is a challenge that may defeat even computers.

In an experiment conducted last year, NSF submitted 52 applications to electronic peer-review. After the agency mailed the applications by regular post, the panellists submitted their reviews and exchanged comments over Internet, a nationwide computer network.

Overall, the experiment was generally a success. NSF found the comments of the 'e-panels' to be more thoughtful and the reviewers more prepared than in similar face-to-face panels. But they also noted that interaction among the panel members ranged from minimal to virtually non-existent.

"There was very little exchange of e-mail," one officer wrote in a NSF report on the project. "In one panel it was because the opinions were unanimous. The other panel was a disaster. I couldn't get them to do much of anything."

Reviewers, of course, liked not having to travel to Washington, DC. (So did NSF. Bringing a scientist to headquarters costs the agency about $1,000 per day. NIH spend more than $20,000 for each of their three-day study sections.) Most reviewers also said they could live without the body language and verbal clues of a face-to-face panel. For small (3-4 people) groups with three to six proposals each, the extra time to prepare thoughtful comments and opinions was worth the lost personal interactions, they said.

NSF, which tends to have smaller review groups and to give programme officers more say over funding decisions, may eventually be able to adopt e-mail reviews for the two-thirds of all reviews that are now conducted at least partly with face-to-face groups.

The NIH, on the other hand, depend almost exclusively on their study sections, which usually number about 20 people — probably too large for e-mail review. For some special reviews, however, NIH assemble panels of as few as five reviewers. In past experiments, NIH have occasionally convened panels by conference call and — in at least one abortive trial — mail.

The agency found that conference calls appear to work relatively well at a pinch, although they have none of the advantages of face-to-face reviews (the nonverbal communications) or e-mail reviews (the more careful consideration). But getting reviewers to respond by mail turned out to be hopeless. Almost all the comments came in late, and some never came in at all. "We had to throw some reviews out altogether because we didn't get even three responses," says John Mathis, who ran the NIH experiment.

Until researchers learn to type as fast as they can talk, they are likely to resist being handed a stack of grants for electronic review. Although the trend towards increased use of e-mail is clear, for now, most reviewers would rather fly to Washington than write a ream of comments about somebody else's grant. **C.A.**

architecture' or text format, as well as two different word processor programs that could understand the format. But the universities never reached the point at which their software could share files, and the project was killed last year.

The only concrete product to come from the NSF project was a simple text processor called PS-Express, which is now widely distributed among scientists. It converts a simple list of data elements (such as 'Last Name = Mathis') into a file written in the common Postscript graphics language. When sent to a Postscript-compatible printer, the file prints out an entire NSF application form with all data filled in.

NSF also accepts PS-Express files electronically, over the Internet computer network. Some 200 applications have been filed that way in the past two years.

But electronic submission at NSF "is still a very hand-held process," says Lawrence Edwards, NSF senior project manager for office information systems. "When we get an application electronically, I print it out, take it downstairs and put it in the queue, just like it came in the mail."

NSF is now developing a simple 'extract' program that will read the PS-Express files and automatically transfer 20–30 essential data elements into the main NSF database, without the need to type it in. That saves time, and more importantly, errors.

But more ambitious projects are in abeyance until the NIH experiments prove that researchers, administrators, agency officials and the technology are all ready for the leap.

So far, government acceptance of the electronic grant projects has been cautious — for good reason. Although the technology has come far in the past ten years, most computer monitors are still barely adequate to display an entire application page at once, clearly or not. "I'd hate to read a proposal on the screen," Edwards says.

And at NIH, Mathis is still fighting computer phobia. "We're waiting for a generational change," he says. "People keep telling me, "John, what you're doing is terrific. I just hope I retire first."

Mathis takes the long view. "Everybody knows that (electronic grants) are inevitable," he says, "it's just a question of when to buy in. If you want to be on the cutting edge and to have a lot of fun, you do it now. Otherwise, you step back and let everybody work the bugs out."

Bugs or not, cultural resistance remains the largest hurdle to electronic grants. Mathis and his staff spend much of their time visiting universities, other parts of NIH and federal agencies to preach the gospel of computerized applications. These "dog and pony shows", as Mathis describes them, are intended to create a groundswell of demand. Until Mathis and Edwards can convince university administrators that electronic grants save time and trouble, the weak link in the chain will continue to be the human one.

Christopher Anderson

TELECOMMUNICATIONS

Satellite aids sore fingers

Munich

As anyone who has tried in recent months to place a call from western Germany to eastern Germany can attest, the two telephone systems are anything but unified. A re-dial button or a rubber finger is a virtual necessity, since the few available lines are always busy.

But now the national telephone company Telekom is bringing in high technology to widen the bottleneck in at least a few geographic areas until a more thorough upgrading of eastern Germany's antiquated system can be carried out. Earlier this month, Telekom began switching calls between some eastern and western cities by satellite in an efficient, if expensive, attempt to alleviate the situation.

From 5 April, Telekom made available 30 additional satellite lines between the western city of Hamburg and the eastern city of Dresden to complement the paltry 24 land lines previously available.

Hamburg has a population of more than 1.6 million; Dresden has 500,000 residents and is the third-largest city in eastern Germany. An additional 36 lines are expected to be added later this month.

It is the first time a satellite has been used to route public calls between the two parts of Germany. The satellite, known as Kopernikus, is normally used for intercontinental calls.

But the stopgap use of the satellite does little to ease the misery of private and corporate customers in other regions of Germany. Telekom, and the Ministry of Post and Telecommunications to which it belongs, have been lambasted in the German press for their sluggish response to the immediate need for more telephone lines between the two regions of Germany. As Telekom has a monopoly on offering basic telephone service, there is nowhere else the customers can turn.

Telekom is planning to invest DM55,000 million (about $33,000) by 1997 to rebuild the neglected eastern German telephone infrastructure. A temporary network, known as an overlay network, is expected to be in place by July. It will be used as an adjunct to the existing network in eastern Germany, most of which was installed back in the 1920s.

Steven Dickman

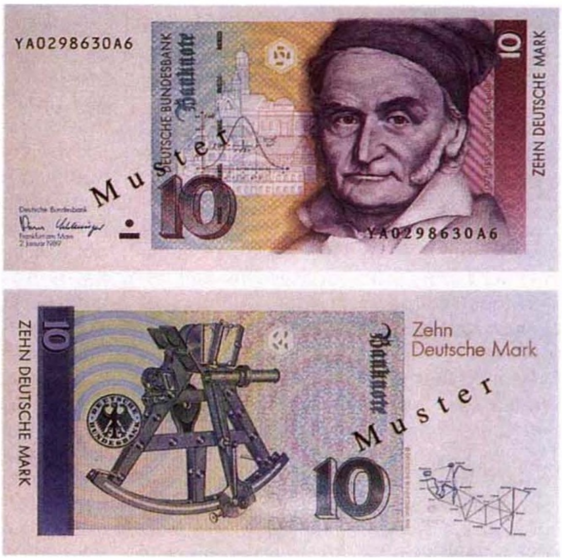
MONEY MATTERS

Gaussian curve graces banknote

Göttingen

The German mathematician and astronomer Carl Friedrich Gauss (1777–1855) is honoured on a new German 10-mark banknote issued on 16 April in Göttingen. The bill marks the second time in as many years that a German banknote has been issued featuring a scientific luminary. Last year, immunologist Paul Ehrlich was so honoured (see *Nature* 347, 415; 1990).

Gauss, for whom approximately 50 mathematical laws, formulae and methods have been named, was head of the Göttingen astronomical observatory from 1807 to 1855. One of the founders of modern geophysics, Gauss became famous during his lifetime for his method of measuring magnetic fields in absolute units, which later became known as gaussian units, including the gauss (for magnetic field strength).



Gauss is latest in the line of scientists to receive recognition on German currency.

In addition to a portrait of Gauss, the face of the note features the familiar gaussian distribution. The reverse side features a 'viceheliotrope', a type of sextant used for surveying invented by Gauss to divert a ray of sunlight to a distant observer. Circles in the background represent stylized planetary orbits and magnetic fields.

Gauss is latest in the line of scientists to receive recognition on German currency.

In 1992, a third figure from German scientific history, this time a woman, will appear on a new 500-mark note: Maria Sibylla Merian (1647–1717),who compiled a famous catalogue of drawings of insects. The series of notes is designed to depict great personalities of German cultural life.

Steven Dickman