in the computers. "They take all that stuff and dump it into their computers. It would be totally impractical to sort it out before it enters the files," says one source.

Telephone conversations, however, cannot be monitored as easily and automatically. Experts agree that spoken language, with its continuously variable sounds, is now decipherable as coherent language only by the human ear. Researchers at IBM cannot get their machines to take continuous speech and accurately transcribe it to written language. Thus, sources assume the NSA must use people—probably military recruits from the Army Security Agency and the Naval Security Group—to listen to recorded conversations, decide which are "of intelligence interest," and make transcripts of them for the files.

The problem of computerized speech recognition, which received a lot of Defense Department support in the early 1970's, has proved enormously difficult to solve. At the IBM Corporation, researchers use the company's most advanced commercial machine, the 370/168, and an artificially quiet room, to try to achieve some recognition of continuous speech.

Raj Reddy, a professor of computer science at Carnegie-Mellon University, says he works with a fairly sophisticated computer that can recognize 1000 acoustically distinct words. Reddy is convinced that NSA can't do much better, either, at the moment. He adds, however, "I have no doubt that the technology will be available in 15 to 25 years for NSA to transcribe phone conversations on a mass scale."

Reddy and others have speculated, however, that the NSA might use other speech recognition devices to weed through masses of recorded telephone conversations and select out ones in which key words appear.

Reddy cautions, however, that such recognition devices could be foiled. "You can cough or whistle in the middle of a key word, and the machine will miss the word and the entire conversation. Or if you know the machine is searching for 'assassination,' you could plant large numbers of conversations containing the words 'a fascination.' "

The extent of NSA's listening to international telephone traffic is not known, but one knowledgeable source told *Science* that NSA is "disillusioned" with searching through ordinary telephone traffic because "people assume the phones are bugged and when they have something important to communicate, they don't say it over the phone."

The source went on to offer a glimpse of the bizarre mental logic of the professional eavesdropper: "But NSA doesn't want it known that they're giving up listening to phone calls because they think it will encourage people to say important things that the NSA then won't be able to pick up." According to this reasoning, then, the NSA is actually afraid that people might use the international phone system for their private communications!

Giant computerized files, accessible by key words, are widely said to be the other main element of NSA's vacuum cleaner operation.

Large data banks are currently in commercial use; law firms, for example, have automated files that, in minutes, can scan all federal court decisions for the last quarter-century. One source says of these systems, "You should assume that NSA is light years ahead of what is found in the commercial marketplace."

In fact, without discussing computers as such, NSA director Lieutenant General Lew Allen, Jr., testified in 1975 that these search and retrieval methods are used. "The use of lists of words, including individual names, subjects, locations, etc., has long been one of the methods used to sort out information of foreign intelligence interest value from that which is not of interest," Allen said.

Several sources confirmed to *Science* that NSA continues to forward some number of telegrams, telex messages, and transcripts of telephone communications—sometimes with proper names de-

Briefing

Future Doctors Balk at the Bill

One day early last March students at the Northwestern University Medical School were startled—and outraged—to learn from the Chicago newspapers that in the fall their tuition would go up from $4350 a year to $6855, or a cool 57 percent.

A tuition increase was expected but the students had assumed that it would be in keeping with the increases previously imposed, which since 1970 had been running at about 10 percent a year. After this bolt from the blue, student representatives—encouraged by a sympathetic resolution by the Medical Faculty Senate—tried repeatedly to persuade the university to reconsider its action.

But, finally convinced that they were getting nowhere, the students anted up $12,000 for a legal action fund and, on 2 August, 260 of them—or more than 80 percent of the members of the rising sophomore and junior classes—brought suit against the university in the Cook County Circuit Court. They asked the court to order that the tuition increase be rolled back to one of no greater than about 10 percent. The university has until early September to reply. A similar suit that was brought against George Washington University 2 years ago was subsequently dismissed.

The students' argument is that the Medical School, by enrolling the students under certain terms and conditions, entered into an implied contract with them that is subject to only "reasonable" changes. They contend that the 57 percent increase cannot be justified as in keeping either with the tuition charged by other private medical schools or with changes in the university's own financial needs and circumstances.

It is true, according to a recent survey made by the Association of American Medical Colleges of the 48 private medical schools in the United States, that only three—those at the Rush Medical Center in Chicago and at Georgetown and George Washington universities in Washington—now charge higher tuition than Northwestern (the Georgetown tuition of $12,500 a year is $3000 higher than any other school's). Tuition at Northwestern is now $1500 above the national average. It is also true that the big increase there was not dictated by loss of revenues.

Why, then, has Northwestern jacked up the tuition so high? The day after the students filed suit, Raymond W. Mack, the university provost, explained: "In recent years, the medical school has been too dependent on capitation grants from the federal and state governments. These grants are subject to change; and there is a growing propensity for the federal government to impose conditions [see related article on page 1066]. . . . Northwestern does not want to make drastic operational changes because of any drastic changes in the level of capita-

leted—to other agencies when so requested. The requests can be for vague economic information, such as Soviet grain prices or Arab petrodollar flow, as well as for information obviously concerned with national security.

Sometimes, apparently, NSA has resisted attempts by other people in the Executive Branch to invade the privacy of U.S. citizens or corporations. In one case, a cabinet-level official in the Nixon Administration is reported to have demanded that NSA provide him with the name of an American corporation whose name had been blotted out from a cable he was reading. NSA refused. Angered, the Cabinet officer appealed to the Director of Central Intelligence, who has oversight of the NSA, to hand over the name anyway, but the Director of Central Intelligence also refused. One NSA critic warns: "This was a case in which NSA looked good. But given another director, of NSA, or a differently inclined director of central intelligence, the outcome might have been different."

The IBM Corporation's Richard Garwin, in a paper on technology and intelligence, has proposed several ingenious technical means for making large data banks less vulnerable to abuse. Among other measures, Garwin suggested that the computer be programmed to keep "an indelible record of who has queried the file and what questions were asked, so the failures of access limitations will not go undetected."

Besides all this recording, storage, and retrieval capability, the modern eavesdropper has at his disposal today's international communications network, which offers many tempting points at which he can intercept thousands of messages at a time.

Communications system experts agree that interception of the undersea cables that carry about half of the U.S.-overseas traffic, would be difficult and expensive. But once out of the water, the cable messages are often transferred to microwave towers, which repeat them and send them along to other towers. "All you need would be a receiving station, placed correctly on high ground between towers, to pick up the entire transmission traveling along that route."

Satellite-transmitted messages also offer many possible intercept locations. Ground stations, such as that located at Etam, West Virginia, have large antennas capable of directing the signals to the satellite with great accuracy. However, the antennas on the satellite are smaller, and they direct the signals back to earth with less precision; they can fall over an area perhaps thousands of miles square.

Thus, while much of the U.S.-to-Britain traffic is received in England at a station at Goonhilly Downs, Cornwall, which is operated by the British Post Office, the signals could also be picked up in their entirety by another receiving station on a ship offshore, or by a land-based receiver in England or Northern Europe. "You'd just call it a radio astronomy observatory or something," says one expert.

Officials of the major communications companies admitted that such interceptions could take place without their knowledge. AT&T's counsel for security, H. W. William Caming, asked whether the company had knowledge of such interception, replied, "We refer all queries regarding national security to the Department of Defense." The executive vice president of Western Union International, Thomas Greenish, asked by *Science* whether he knew of any recording by the NSA of international telegram traffic, said, "I have no knowledge of it. I doubt it. But it could be happening."

Law Limps Behind

The technology by which NSA allegedly "scoops up" the international communications to and from the United States has raised a number of controversial legal questions. Some of these may come to a head during discussion of the new wiretap bill before Congress later this fall.

The only restraint on NSA's current retention and forwarding of the massive

Briefing

tion grants; and it wants to remain in a position to refuse the grants if attached conditions are unacceptable."

The provost also repeated earlier assurances given by the university that no medical student would be forced by financial reasons either to drop out or to incur an indebtedness of greater than $22,500. Northwestern claims that its aid program is exceptionally good. To keep it that way, the university has promised that $1.1 million of the federal and state capitation money which it receives this year will go into the student aid fund. Also, the terms of interest and the payback and forgiveness provisions that apply to student loans are said to be generous enough that no student's career options will be effectively limited to ministering to the rich.

Yet the fact that better than three-fourths of the medical school's sophomores and juniors are suing the university shows that the students are distrustful or unimpressed by such assurances. Jack O'Dowd, Northwestern's director of university relations, has an explanation for this too, however.

"The administration of the medical school botched this," he says. "The increase should have been explained to the students before it was imposed. The lawsuit is, I think, a direct result of our bungling the original announcement."

Sandwiches and Beer for the Press at ACDA?

Thomas A. Halsted, who as executive director for the Arms Control Association (ACA) for the past 5 years has been pretty effective at getting press attention for his group's views on SALT negotiations and arms policies generally, has now gone to the Arms Control and Disarmament Agency (ACDA). There he will be public affairs adviser to the director, Paul Warnke. Part of Halsted's success at ACA in cultivating the press was due to his frequent scheduling of noon luncheons at which arms control specialists such as Warnke and Herbert Scoville (a former ACDA and CIA official) would meet with a select group of Washington reporters over sandwiches and beer.

Still very new at ACDA, Halsted may be looking back over his shoulder since the conservative columnists Evans and Novak blasted Warnke recently for bringing him in to replace Pedro Sanjuan, whom they credit with enjoying the confidence of "defense minded congressmen." Sanjuan has been reassigned to the White House staff, where he will reportedly help lobby for Senate ratification of any new SALT agreements.

Halsted has promised Warnke that he will help build a climate of opinion for arms control. He observes that it is too early yet for him to say whether the sandwich and beer press luncheon will be appropriate in his new job.

Luther J. Carter