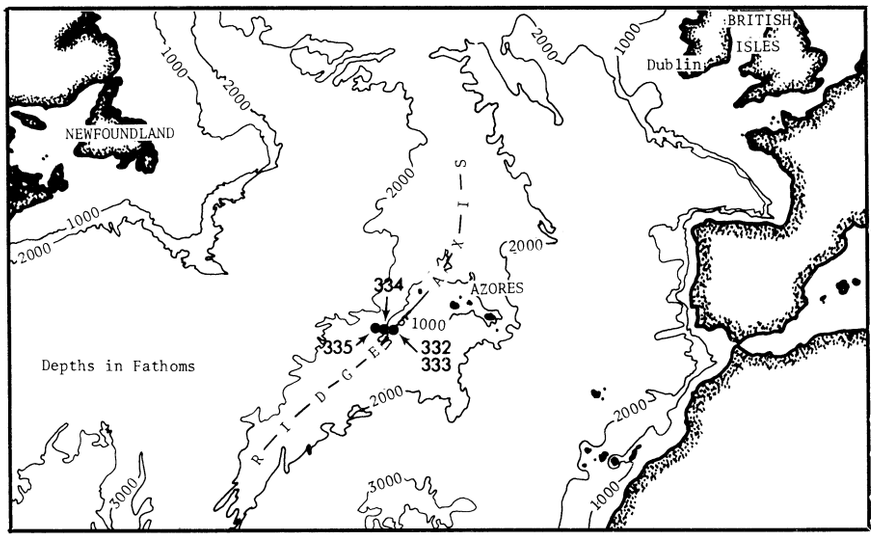

Challenger's record-deep holes, including 1,910-footer at site 332, near Rift.

invariably meant that a borehole was as deep as it was going to get. Once the flexible, multi-sectioned shaft called the drill string was pulled out of the hole it had created, the odds against relocating the hole from the ship overhead were astronomical. Dull bits were not always to blame. Currents and wave motions could have an effect, as could the mere bobbing and turning of the ship.

Deep Sea Drilling Project engineers found their answer in a technique originally conceived but never implemented for the Mohole, a stillborn idea for drilling through the so-called Mohorovicic discontinuity between the earth's crust and mantle. It's simply an embodiment of that time-honored implement for pouring things into awkwardly small holes: the funnel.

As the Challenger applies it, a 150-foot section of pipe topped with a 14-foot-diameter cone is lowered to the ocean floor via the drill string (a tube made of 30-foot, threaded sections of steel pipe), where it settles into the bottom sediment until the cone rests on the sediment surface, large end up. A wire, lowered down the pipe, trips a latch that frees the drill bit to begin working away until it becomes dull. Drill string and bit are then pulled up, the bit is changed on shipboard, and the whole string is lowered again, this time carrying a scanning sonar device that seeks out three sonar reflectors mounted on the rim of the cone. The sonar can spot the reflectors from as far away as 500 feet.

Guiding the drill string to relocate the cone requires moving the entire ship, following the sonar blips on a monitor screen. The Challenger is particularly qualified for this task, being equipped not only with regular ship's propellors, but with additional screws that point sideways—the ultimate answer to parallel parking. (When the Challenger pulls into a port, says one project official, the captain sometimes likes to wave off the assisting tugboats and glide laterally—and dramatically—over to the dock.) Once the cone is directly beneath the sonar transmitter on the drill string, the rim of the cone itself acts as a reflector, signalling its presence by showing up as a ring on the monitor screen. The bit slides in.

The reentry technique was first tested three years ago during Leg 11 of the project, when its success was greeted with a pleased and lusty cheer from those aboard. It was first used operationally during Leg 14, on Christmas Day of 1971, and has since worked at water depths as great as 13,000 feet. But it was not until Leg 37 that it really began to show its true potential.

To further evaluate the technique, next week one of the Famous submersibles, Woods Hole Oceanographic Institution's Alvin, is scheduled to visit one of the drill sites to see, for example, how far the cone sinks into the sediment with use. □

What's happening to inventions?

Something very peculiar is happening to the American technological innovation process, at least to that part of it reflected in patent applications stemming from Federal research and development funds. According to a new report by the Federal Council for Science and Technology (FCST), the total number of patent applications resulting from public funding has decreased sharply and steadily since 1966 and the total number of invention disclosures (for which patent applications might or might not be made) has also declined steadily since 1968. The total number of these invention disclosures in 1972, the last year included in the study, was 9 percent less than the number registered a decade earlier. In the same period, patent applications for *all* inventions (not just those resulting from Government funding) rose.

No one has rushed forward with a comprehensive explanation for the sudden dropoff. Earlier in the decade, a rise of patent applications by Government employees and contractors paralleled rising R&D budgets. But when the budget bottomed out in 1971 and then rose some 7 percent in 1972, the descent of invention disclosures actually sharpened its rate of decline slightly. Even more puzzling, in 1971 the President issued a memorandum instituting a new policy permitting private industries, for the first time, to be granted exclusive rights to Government-held patents, under special circumstances. But the result, instead of an anticipated upswing in applications for such licenses, was the decade's first substantial downturn in that phase of national innovative activity.

Some industries have been disgruntled by moves in Congress to change patent laws to make results of work funded by the Government more widely available. "Under these circumstances," testified N. Bruce Hannay of Bell Laboratories, "the companies with the greatest competence to carry out the [resulting] program may be discouraged from participating." Sen. John L. McClellan (D-Ark.) told an interviewer recently he thought the problem centers on uncertaintly in what restrictions a patent owner may place on the licensing of his patents without violating antitrust statutes, and he called for clarification of the issue in upcoming legislation. On the one hand stands the public's right to benefit from publicly funded projects; on the other, a company's disincentive to produce an invention it will immediately have to give away.

The patent-granting procedure has come a long way since gadget-loving Thomas Jefferson (then Secretary of State) first reviewed all applications personally. More than three-quarters of patents now go to corporations, with those resulting directly from Government R&D representing about 3 percent of the total. Though the procedure is costly and time-consuming—involving about $225 in official fees, an average of $1,000 for a patent lawyer, and a two-year wait—these should not prove major impediments to big companies. A more serious threat, one industry patent expert told SCIENCE NEWS, is the inability of companies to patent computer "software." Another industry source said this might cut down on new patents but could not account for the decline reported by FCST. Another blamed the shift to "systems" contract-

ing in which prime contractors do not filter down as much R&D funds to their subcontractors.

The problem is, no one is quite sure how funding stimulates inventiveness. If one divides total Federal R&D funding by the number of inventions, the "cost" per invention for the Department of Defense, NASA and the Atomic Energy Commission (which account for the bulk of patents) runs between one and two million dollars apiece. For agencies involved more in pure research, such as HEW and NSF, the cost jumps to $8 million. Patent policy clearly needs more study, and probably new priorities. □

Vinyl chloride at molecular level

When the recent tragic deaths of 15 vinyl-chloride workers became public, people were alarmed. They worried about the 30,000 other vinyl chloride workers, and wondered if the ubiquitous polyvinyl chloride plastic products themselves could cause liver cancer (angiosarcoma) or other cancers. These plastics are present in almost every home, office and factory, primarily in the form of pipes and conduits, and floor and furniture coverings. When the questions came, scientists, industry and government alike were caught with their data down. They didn't and still don't have much information on what plastics in general and vinyl chloride in particular do to the physical and biological environments.

In an attempt to fill in some of these gaps and anticipate future health problems from plastics and plastics manufacturing, the National Institute of Environmental Health Sciences (NIEHS) conducted a conference this week at Pinehurst, N.C., with participants from the plastics and chemical industries, government agencies and universities. Emerging from the conference was a clearer picture of how vinyl chloride affects the human body and of the magnitude of the plastics problem. Vinyl chloride, it seems, is only one of many highly toxic, possibly carcinogenic substances to which chemical workers are exposed. The chemical and physical actions and interactions of polymer substances as they degrade and wear are just beginning to be understood.

Several researchers presented new findings on vinyl chloride. It appears that after vinyl chloride monomers (single molecules) enter the body, they are attacked by an unknown enzyme and break down into the chemical monochloroethylene oxide. Benjamin L. Van Buuren from the New York University Medical Center reports that vinyl chloride molecules might first bond to membranes or other cell proteins before being broken down, then be "activated" into a carcinogenic species. Van Buuren also suspects trichloroethylene, a substance similar to the vinyl chloride breakdown product, to be a possible carcinogen. It is widely used in industry as a degreasing agent, and is also used by some dentists as an anesthetic during oral surgery. It should be closely controlled, he says.

Two other research groups confirm the possibility of membrane attack by vinyl chloride. Three biochemists from Dow Chemical U.S.A. in Midland, Mich., Robert E. Hefner, Jr., Philip G. Watanabe and Perry G. Gehring, report that the breakdown products react with nonprotein sulfur-containing cell constituents such as glutathione and cysteine. A team from the Harvard School of Public Health, Rudolf J. Jaeger, Rory B. Connolly and Sheldon D. Murphy, report that starved rats were more susceptible to the effects of vinyl chloride and that this is probably associated with depletion of glutathione during fasting. Although glutathione is not a well characterized compound. Jaeger says, it is probably associated with membrane and organelle stability. Depletion of it probably leaves the membranes less protected against attacks from foreign substances.

Although some participants thought the blame for the dangers associated with plastics manufacturing should be shared by science, industry and government, others feel lax government regulation is chiefly at fault. "Many of the regulatory agencies are jealous of each other, and guard their own particular function and don't want to step on each other's feet," Van Buuren told SCIENCE NEWS. "The scientist-administrators in these regulatory agencies know their bosses have to report to Congress, and want to go with the best possible results. Because of this they have not been as vigilant and responsible as they should [in regulating the plastics industry]," he says.

NIEHS Director David P. Raul says manufacturers have not had sufficient data and that inadequate funding of research is largely at fault. He also feels the toxicology-standards legislation now before Congress would be an important factor in regulation, and he hopes the conference discussions will encourage its passage. □

Minority grants: Health, writing

Minority training grants totaling more than $5 million have been awarded to several professional associations to help prepare minority mental health professionals and minority science writers, the Department of Health, Education, and Welfare announced.

About $5 million has been allocated to five mental health organizations to provide graduate fellowships for about 215 minority students over a period of six years. Receiving the grants will be the American Psychological Association, the American Psychiatric Association, the American Sociological Association, the Council on Social Work Education and the American Nurses Association. Funding the students through these organizations, rather than universities, should reduce the administrative costs and give the students more geographic choice. They will receive standard $2,500 annual stipends throughout their graduate training.

The program is intended to steer qualified students into careers in the social sciences, nursing and mental health fields. Each organization will determine guidelines for academic qualifications and financial need.

"Even though a student has finished college, it does not mean he or she is not needy," says James R. Ralph, chief of the National Institute of Mental Health's center for minority group mental health programs. "Each group will go out and beat the bushes for kids with potential. We are hoping to produce people who will assume leadership roles in their own communities."

For the program to train minority reporters in the field of health and science writing, $100,000 was awarded to the Council for the Advancement of Science Writing (CASW). Nine reporters from minority newspapers, magazines and broadcast stations, now being chosen, will attend a one-week course at Northwestern University in Evanston, Ill., then will cover medical and scientific conferences and visit research laboratories. The CASW will monitor minority media science coverage throughout the year.

Although the reporters will not be required to have a formal science background as is often the case with science writers, Ralph says, "We are hoping that minority publishers will nominate reporters for the program who are interested in science and have a basic understanding of the field. There is a crying need for health information in minority publications, and many people only read these publications. We have to get the word to them that health care is a right, not a privilege."

Although many small broadcast stations and publications cannot afford to cover specialized areas such as science, Ralph says, "We hope that minority editors will see science and health coverage as enhancing their capacity to serve their readers." □