awaiting final approval, SELENE would use NASDA's H-II rocket to send into lunar orbit a 1.5-ton package containing a low-altitude orbiter, a lander, and a high-altitude, data-relay satellite. In addition to refining and extending many of the elemental and magnetic observations of the Lunar Prospector, SELENE will produce high-resolution topographic maps and detailed observations of the magnetic characteristics of the moon's far side, as well as study Earth's plasma environment and magnetosphere. The data should flesh out sketchy maps of the moon's surface, helping scientists to understand its varied features and engineers to pick out the best sites for future landings, and may also offer insight into the origin and fate of a possible ancient magnetic field.

The moon has moved to the top of Japan's space plans because of its broad appeal. Mizutani says it offers researchers both a chance to do interesting science and a relatively inexpensive test bed for techniques to be used on more distant objects. Those practical considerations are music to the ears of Masanori Homma, manager of the policy and strategy department at NASDA, the more commercially oriented of the country's two space agencies. "When you think of space applications, the moon is a very appropriate target," he says. With such interest on the part of both space agencies, it was a small step for Japan's Space Activities Commission, which advises the government on space policy, to make the moon one of the focal points of a 1994 report laying out a long-term vision for space.

Scientists at the meeting from other countries say their programs are not keeping pace with Japan's level of activity. U.S. attitudes have been shaped by a "been there, done that syndrome," notes Stephen Saunders, senior research scientist at the Jet Propulsion Laboratory in California. Europe has never had much of a lunar focus in its space activities, says astrophysicist Jean-Pierre Swings of the University of Liège, Belgium, although there is talk of resurrecting a proposal to launch a remote-sensing satellite that was rejected earlier this year in the most recent competition for the European Space Agency's Horizon 2000 program. And the once-proud Russian space program has shrunk considerably in the wake of the country's fiscal problems.

But Japan soldiers on, and scientists say its lunar activities could get a boost from the attention now being lavished on Mars. Duke says that the recent excitement about possible evidence of ancient life on Mars has revived talk of manned missions to the planet. Those plans would almost certainly include preparatory manned missions to the moon. If so, Japan stands ready to provide important clues about the nearest stepping stone to space exploration.

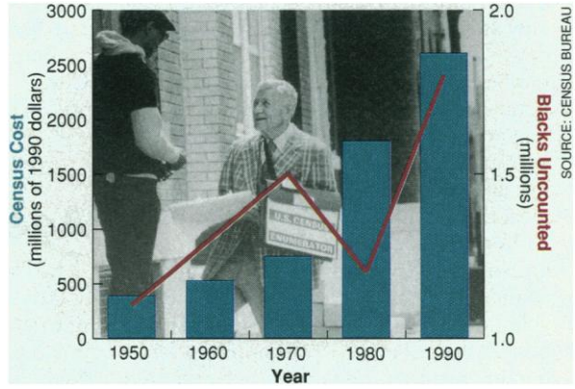
–Dennis Normile

DEMOGRAPHY

A Census in Which All Americans Count

The U.S. Census Bureau has a tough enough time dealing with ordinary Americans. Some people hid behind curtains, recalls Valerie Ramsay of San Jose, California, who was a door-to-door interviewer, or enumerator, for the 1970 census. Others unleashed their dogs. She even had one "older gentleman" holler at her, "Get the hell off my porch. The U.S. government knows too much about me as it is!"

Now another group of Americans, the U.S. Congress, is assailing the often-beleaguered bureau over its recent plan to adopt a new strategy for the 2000 census. Eight months ago, the bureau proposed supplementing its traditional door-to-door interviewing approach with a statistical sampling and analysis of the hard-to-locate or impossible-to-interview, like Ramsay's "older gentleman." Bureau officials say the new, two-pronged approach would bring down the skyrocketing costs of trying to count everyone, and correct what is widely viewed as a fundamental flaw of traditional physical tallies—that they undercount poor people and minorities, who tend to move more often and return fewer mail-in questionnaires than do wealthier Americans.



Diminishing returns. Ballooning spending hasn't reduced the number of blacks missed by the census.

Not so fast, said members of the U.S. House of Representatives. In a report released in September, members of the Republican-controlled House Committee on Government Reform and Oversight countered that census totals produced using sampling and statistical adjustment techniques would have their own flaws, including a high built-in error factor at small geographical scales. The critics say that in its zeal to save money and eliminate the undercount, the bureau is sacrificing the high-resolution data needed for accurately redrawing House districts. Both the report and a bill considered by the Senate before Congress adjourned for this month's elections called on the Census Bureau to carry out a traditional physical count, sans sampling, in 2000.

But many statisticians and demographers who have leapt to the bureau's defense maintain that the committee is more concerned about Democrats than demographics. They say that the U.S. population is now too large and mobile for simple physical counts, and that the Census Bureau's Republican opponents are simply trying to avert undercount corrections that could result in a reapportionment of House seats to states with many urban, mainly Democratic areas. "They want the bureau to go out and do a second-rate enumeration, because they know what the outcome will be relative to their constituencies," says Stephen Fienberg, a statistician at Carnegie Mellon University in Pittsburgh. "This denigration of sampling is unconscionable; I don't think the professional community should stand for it."

By all accounts, the census needs fixing. According to a National Research Council report released last year, the cost of data-gathering has jumped from $11 per housing unit in 1970 to $25 in 1990. Overall, the 1990 census cost taxpayers more than three times as much as the 1970 count. But as costs have increased, so have undercount rates for African Americans (see chart). In 1990, the number of African Americans overlooked by enumerators was the highest ever: some 1.8 million out of a total of about 30.5 million, according to a 1993 demographic analysis by the bureau. "Throwing money at the undercount is not going to solve the problem. The only way we can improve is by [adopting] statistical techniques," says the bureau's associate director for decennial census, geographer Robert Marx.

The bureau's design for the 2000 census calls for sampling in two phases. First, after individuals in at least 90% of households in each census tract have been directly counted, officials will put intensive effort into interviewing a resident in one out of every 10 nonresponding households, and will use this follow-up data to paint a statistical picture of the remaining nonresponders. Then, as a quality-control measure, the bureau will do what

it calls "integrated coverage measurement" (ICM)—in essence, a survey of some 750,000 households that will lead to separate estimates of the size and whereabouts of the population and its subgroups. Physical-count field data and nonresponse follow-up estimates that differ from the survey's results will be corrected accordingly before the final totals are released. The bureau estimates that sampling rather than interviewing the last 10% of the population in 2000 will cost $900 million less than the $4.8 billion it would cost to merely repeat the 1990 census.

Among other criticisms of the bureau's plan is the contention by Republican opponents in Congress that selecting the best statistical models for estimation and adjustment is an "inherently subjective" process that opens the door to political tampering. And academic allies of the committee have put forth their own critiques. As demographer Steven Murdock, director of the Texas State Data Center at Texas A&M University, argues, samples are only as good as the data from which they are drawn. Hard-to-locate rural residents and minorities may still be undercounted during the nonresponse follow-up phase, Murdock says, as they are often underrepresented in the data the bureau uses to compile address lists for follow-up interviewing, typically rosters from previous censuses and U.S. Postal Service records.

Kenneth Wachter, a demographer at the University of California, Berkeley, says that quality-check surveys aren't necessarily reliable either. For instance, he maintains that a postcensus survey in 1990 sampled a larger fraction of minorities in the South and West than in the Northeast and Midwest, thanks to differing patterns of housing, and racial and ethnic self-identification—regional biases that are likely to recur in the 2000 ICM. "If the basic data collection is working unevenly, [quality-check surveys] can amplify" undercounts rather than correct them, he says.

But the larger community of census advisers and users "overwhelmingly supports" the bureau's plan, says demographer James Trussell, director of the Office of Population Research at Princeton University. Congressional critics "are simply not bothering to look at the evidence."

It is a mathematical truism that the smaller the area being sampled, the larger the margin of uncertainty in statistical estimates. But data collected through the bureau's intensive nonrespondent follow-up effort will contain far fewer factual errors than regular field results, more than compensating for sampling errors, says University of Southern California statistician John Rolph, who led an American Statistical Association panel that strongly endorsed the Census Bureau's plans in September. "When taking a sample, you can use a smaller, higher-quality operational staff and have much better quality control than when you are trying to reach every last person," says Rolph.

Further, the bureau's address information is not as skimpy as Murdock implies, says Marx: "As we've done in every previous census, we'll send people out in advance to list every unit they can lay an eyeball on. We make sure they are sent a mail-in form and that they are included in the candidates for nonresponse follow-up if we don't get it back." And as for Wachter's concern about the accuracy of the planned ICM, Census Bureau statisticians can find no evidence of the regional biases in the 1990 survey that Wachter describes, Marx says.

To many statisticians, the committee's report is more than just wrongheaded; it's an affront to their profession. Forbidding the use of statistical methods to determine the population and apportion House seats—as a bill offered this term by Wisconsin Republican Thomas Petri would have done—"really calls into question the scientific validity of the discipline of statistics," says Rolph.

But Pennsylvania Republican William F. Clinger Jr., the retiring chair of the reform and oversight committee, says the experts are overreacting. "Are statisticians offended when our elected officials are elected by physical ballot, rather than by a scientific poll with a measured margin of error?" he asks. "For apportioning the House ... it is essential that we have a census which enables us to draw real lines around real people." As for charges that the committee's recommendations are intended to minimize Republican losses in post-2000 reapportionment, Clinger is dismissive: "There is no question that reapportionment is a politically charged issue ... [but] we have studied the issues of sampling and adjustment on their merits."

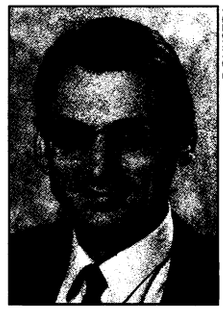
Ultimately, cost may prove to be the deciding factor in how the 2000 survey gets done. While Clinger says that Congress should commit to the full $4.8 billion cost of a physical enumeration, other politicians have indicated that the Census Bureau might not get even the $3.9 billion it has requested for its streamlined plans. The bureau is pushing forward with field tests of statistical sampling. But should future legislation or court challenges nullify those plans, "We've done 21 censuses the old way," says Marx. "We're practiced at that."

–Wade Roush

THE NETHERLANDS

Agencies Protest Funding Reforms

The Dutch research community is reacting angrily to a plan to overhaul the way basic research is funded in the Netherlands. The proposal, the brainchild of Jo Ritzen, the Netherlands' Minister of Education, Culture, and Science, would strip the Dutch Research Council, or NWO, of its responsibility for running labs and turn it into a granting agency, much like the U.S. National Science Foundation. The plan is expected to be debated by the Dutch Parliament next month, but the universities and NWO officials are hoping to head it off by hammering out an alternative in the next few weeks.



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Reformer. Science minister Jo Ritzen.

The main elements of the plan came from an international committee that Ritzen appointed in January to review the functioning of NWO and that included Wolfgang Frühwald, president of the German funding agency DFG, and European Science Foundation vice-president Dervilla Donnelly. The committee came up with a dozen recommendations in June, and Ritzen incorporated them into his plan, unveiled in September as part of the annual research and development budget.

Ritzen's proposal is an attempt to bring more coordination to the multilevel organization of Dutch science. At present, the government spends about $2.9 billion a year on R&D, of which $1.3 billion goes directly to the country's 13 universities. The NWO gets just $340 million and distributes it to the research community via 25 foundations that disburse grants. Mostly this money goes to university researchers but some NWO foundations, such as the Foundation for Fundamental Research on Matter (FOM), run their own institutes.

The review committee argued that the structure should be simpler and there should be a clear distinction between the funding and conduct of research, to avoid possible accusations of conflict of interest. Ritzen's response was to propose that NWO be transformed into a purely granting agency. All 16 institutes run by its offshoot foundations would be placed under the control of a new independent organization, along with institutes now run by the Netherlands Academy of Arts and Sciences (KNAW), which plays a similar role to NWO. The foundations would lose their research institutes to this new organization, but may survive as granting agencies.

While NWO would lose responsibility for running labs, it would gain authority over the direction of basic research. Not only would it