is what we hope to do by reaching an agreement with the Soviets on the details of this transition." The Soviets say this is just a rhetorical trick and note that they are not being offered a veto over the deployment; Nitze and others acknowledge that if an agreement proves impossible, the United States could proceed on its own.

During the first round, the U.S. delegation was willing to negotiate only the method by which existing SALT I constraints on missile defenses might be amended, not the amendments themselves—to talk, in short only about future talks, not about substantive "Star Wars" limitations. A concerted effort to lure the Soviets away from this topic by hinting at the prospect of substantial concessions in strategic and theater nuclear weapons largely failed, according to the senior official who briefed reporters. Included among these concessions

The wild card is public opinion, particularly in Western Europe.

are tight limits on air-launched cruise missiles, in which the United States enjoys a substantial technological advantage; a tacit understanding that the United States would deploy fewer intermediate-range ballistic missiles in Europe than the Soviet Union; and a willingness to drop any direct limitations on "throw-weight," or total missile payload capacity, where the Soviets now maintain a substantial advantage.

The Soviets failed to take this bait, however, and said little about the U.S. offensive weapons proposals and virtually nothing about their own. By the end, only disappointing clues had emerged: The Soviets wanted tougher constraints on U.S. cruise missiles and intermediate-range aircraft and looser limits on SS-20 ballistic missiles than they had been willing to accept during the negotiations that adjourned in 1983. In general, however, when the United States tried to "sort out each one of these sub-issues," as Nitze put it, the Soviets wanted to discuss only broad concepts, primarily in one area.

Ultimately, the U.S. delegation attempted to force discussion of offensive weapons by defining "space arms" so as to include ballistic missiles, which pass through space and have an inherent capability to destroy satellites. But the Soviets resisted, and spoke only of "strike space weapons," *designed* to hit objects in space or from space. They claimed that such weapons are under development only in the United States, and proposed their total abolition. But the United States objected that Soviet research is indeed under way and that anyway it is a weapon's capabilities that matter, not what the designers have in mind. In addition, the delegation said that adequate verification of such a ban would be impossible. There was no discussion of a space weapons test ban favored by many independent arms control experts, and no further progress was made.

Although the Administration is holding its cards extremely close in advance of the second 6-week round, no substantial movement is expected. This is due in part to a widespread conviction within the Administration that the Soviets are not bargaining seriously, and may not be interested in a comprehensive agreement. "What is the point of suggesting concessions from our side if there are no concessions going to come forward from their side?" the senior official told reporters. Some expect progress if Gorbachev gives a speech at the United Nations this fall, and meets with Reagan afterward. But no firm commitment to such a meeting has been made on either side.

The wild card is public opinion, particularly in Western Europe. Nitze believes that the Soviets' principal strategy is to undercut support for the United States through "a hard-nosed propaganda campaign," thereby forcing a one-sided outcome. In particular, he believes that they will attempt to hold an agreement on offensive weapons—which interests the Europeans a great deal—hostage to a resolution of the space weapons issue on their own terms. "Until they realize that their propaganda campaign is not working—that is, that U.S. concessions will not be made unilaterally—the Soviets will not be prepared to negotiate seriously," he says. But neither he nor Administration officials are willing to predict with confidence that the Europeans will side with the United States, as they did in the dispute over the Pershing II and ground-launched cruise missile.

"If it turns out that we have to go for a few more years without a formal agreement limiting offensive nuclear weapons, that is undesirable," Nitze pointedly told the London-based International Institute for Strategic Studies last March. "But let us not panic; we have been living with that situation for some years."

—R. JEFFREY SMITH

Illinois Traces Cause of Salmonella Outbreak

A cross-connection involving a cluster of valves may have linked bacterially contaminated milk and pasteurized milk at an Illinois dairy and caused the nation's worst epidemic of salmonella poisoning, according to a report released on 7 May by investigating authorities. For more than a month, investigators have been probing Jewel food stores' enormous Hillfarm dairy plant near Chicago to try to pinpoint a plausible cause (*Science,* 17 May, p. 829).

The investigative task force, composed of federal, state, and dairy officials, says that they were unable "to reconstruct an unbroken chain of probable events" that led to milk contamination on 20 March, 30 March, and 8 April. But the cross-connection is "the most likely source" of the contamination of the first two episodes, they reported.

The cross-connection was suspected early on as the source, but was disconnected before the contamination occurred on 8 April. As a result, investigators have been puzzled about the chronology of events.

Here is what they speculate happened. In the dairy's 400 miles of stainless steel pipes and hundreds of valves, there is one small section with two air-pressure valves. These two valves—not three as originally reported by a state health official—separate raw milk from pasteurized milk. The valves in this transfer line are normally closed to keep the two milks separate but opened when the whole processing system is regularly cleaned.

Investigators repeatedly subjected these valves to pressure testing with bright red dye, and each time the system worked properly. Then, in one more run of the same test they observed that leaching could have occurred between the two milk lines. Investigators found that when they simulated the flow of milk by pumping clear water through the pasteurized milk line and dyed water through the raw milk line, the air pressure in this section of pipe reversed and became negative. "A mixture of clear and colored water was observed," the report says. The investigation further revealed that milk can sit in this piece of

pipe, which is not refrigerated and can hold up to 3/4 gallon of milk, "for a considerable length of time"—perfect conditions for bacteria to multiply.

In addition, authorities found a 2-inch section of dead space in one of the valves that is not flushed out during routine maintenance, providing another possible site for bacterial growth.

What accounts for the April contamination? Officials discovered that one of the two valves was also attached to a T-shaped piece of pipe and also had a section of dead space where milk could stand. To close off one of the three ends of the pipe, the report said, workers freely interchanged threaded caps from raw or pasteurized lines. The report speculates that a small number of salmonella on a threaded cap could have contaminated milk in the pipe.

One of the baffling facts uncovered early on is absence of the enzyme phosphatase in any of the recovered containers of milk. Raw milk contains the enzyme. The report explains that the level was far below the level of detection. To be detected in a 25,000-gallon tank of pasteurized milk, the volume of raw milk would have to be greater than 25 gallons, it explained.

Other pieces of the investigation are falling together too. Plasmid analyses of the *Salmonella typhimurium* from the recent outbreak match the same strain that caused another outbreak last August in the Chicago area. Hillfarm milk was implicated in that outbreak, but on slim evidence.

The investigation continues. Officials are trying to locate dairy herds that may be harboring the bacteria in order to buttress their theory that the bacteria originated from outside the dairy.—**MARJORIE SUN**

Engineering "Crisis" Abating, Study Says

Alarmed sounds to the contrary, the engineering profession is in rather good shape, according to a National Research Council report, "Engineering Education and Practice in the United States." The quality of engineers is climbing; the scope of engineering is broadening. The profession, the most numerous one in the country after teaching, has the lowest unemployment rate—2 percent.

According to a committee headed by retired IBM executive Jerrier A. Haddad, the most persistent problem is the shortage of faculty in doctoral-level graduate programs. Foreigners holding temporary visas occupy 40 percent of these positions. Nonetheless, the report says the most recent data indicate that engineering faculty are "no longer leaving the schools at a significantly greater rate than they [are] coming in from industry," and that increasing numbers of native entering doctoral students offer hope for future faculty augmentation.

Some universities are complaining that they do not have the equipment or the manpower to meet growing student demand. On the other hand, the vigorous competitive situation is resulting in engineers with "dramatically higher communication and social skills"—and SAT scores—"as compared to past stereotypes of the engineer."

A cloud on the horizon is evidence that the number of women and minority people entering the profession has been leveling off. Female enrollments in undergraduate engineering programs began a precipitous climb in 1972, reaching 15 percent by 1984. But now it looks as though further progress will depend on more early exposure to science and math. "Even high school is too late," observed panel member Jordan Baruch, who suggested at a briefing that professional societies could do much more to get the "taste of engineering down into childhood."

Yet to appear from the study, which was commissioned in 1980 by the National Science Foundation (NSF), are companion reports on research, education (including continuing education), and employment.

Details on "Participation of Foreign Citizens in U.S. Science and Engineering" is offered in an NSF report that appeared in January. This reveals that as of 1983, almost one quarter of all graduate students were foreigners, the commonest countries of origin being China and Taiwan, India, Iran, and Korea. Over half of those who obtain doctorates in the United States stay here, and increasing numbers are reporting postgraduation plans to work in this country.

—**CONSTANCE HOLDEN**

International Primate Campaign Launched

The World Wildlife Fund (WWF) has commenced a major campaign to save the world's wild primates that will entail raising $1 million within the next 5 years.

Primates are serving as the "flagship species" to focus public attention on the need to stem the destruction of rainforest habitat, which is disappearing at a rate of 10 to 20 million hectares—or an area about the size of New York State—per year. About one-third of the 200 primate species

Russell Mittermeier

Brazilian muriqui

are threatened, and one in seven will be extinct by 2000 unless action is taken immediately, according to campaign director Russell A. Mittermeier.

The WWF, which already spends $300,000 to $400,000 a year on primate programs, has formulated a detailed Primate Action Plan covering research, education, and training. Special attention will be focused on Brazil, which is home to 25 percent of the world's primates; Madagascar, which sustains a variety of unique species of lemurs; and central Africa, where a variety of new gorilla programs are being launched.

Although primates' habitats are being destroyed at a frightening rate, WWF-U.S. president Russell Train observed at a news briefing that officials of the countries in question are becoming increasingly eager to cooperate in conservation efforts. For example, the muriqui of Brazil, a rare monkey with unique human-type traits, was virtually unknown 5 years ago. Now it is featured on Brazilian stamps and telephone books and seems to be on its way to becoming the "panda" of Brazil.

—**CONSTANCE HOLDEN**