horizontal cases that might or might not contain ICBM's in launch canisters.

The vehicles would go through the motions of removing and depositing missiles in all the holes in a procedure designed so that Soviet aerial reconnaissance could not determine whether a missile was actually being removed or inserted. In fact, there would be only one ICBM for every 20 holes; but Soviet reconnaissance would not know, at any particular time, which holes contained ICBM's.

Moreover, since the missile housed in the system would be the MX, the destructiveness of the surviving U.S. ICBM force would be sufficient, the Air Force argues, to deter the Soviets from trying a first-strike attack. In short, to the tune of $22 billion to $32 billion, the Air Force would play a giant shell game with Soviet missile targeters.

Another proposed solution is the so-called trench system (see photographs). In this variant, the mobile missiles in the 50- by 100-mile missile field would all be underground, in trenches 12 to 20 miles long. One missile, it is presumed, would be in each trench. The trenches would be constructed to allow the missile to be launched from any of a number of "aim points." The trench system's arithmetic is similar to that of the vertical silo system described above; the missile field area would contain 250 trenches with 250 missiles, and would present Soviet targeters with 5000 aim points. Presumably, the Soviets would not know at any particular time where the 250 missiles were located.

Still another scheme is the "garage." In this plan each ICBM would live in its own garage, where most of the time Soviet reconnaissance could verify its location. But when the United States learned that a Soviet ICBM attack had been launched, each U.S. ICBM would begin moving along one of the spokelike tunnels radiating from its central garage, toward one of ten points in the tunnel from which it could be launched. This system purports to outwit Soviet targeters, who must program their missiles before launching them. So far, at least two opposed schools of thought have been emerging on all these schemes, which are called multiple aim point (MAP) systems because they all embody that common objective. The view that appears to have the upper hand within the Carter Administration is that since SALT does not really solve the problem of the vulnerability of U.S. land-based missiles, and since MAP might do so, MAP is an essential complement to SALT and should be proposed concomitantly.

The contrary view, held by some members of the arms control community, is that MAP poses serious problems of verification. How can the Soviets be sure that there is not an ICBM in *every* MAP hole? And, when the Soviets have their own MAP, how can the United

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Senate Bill Gives Bright Idea Back to Inventor

A chronic complaint of universities is that government rules on the transfer of patents derived from federally funded research are so thick with red tape that it saps the incentive to be inventive. Years can slip by before a funding agency decides whether or not to return patent rights to the inventor's organization, and, as often as not, the agency decides to hold on tight.

A new Senate bill, however, will try to cut the bureaucratic knots by automatically assigning limited rights to the inventing organization. Introduced by Senators Robert Dole (R–Kans.) and Birch Bayh (D–Ind.), the bill would give universities, nonprofit organizations, and small businesses the lion's share of the commercial benefits from their federally funded research.

Under the bill, the inventing organization could license a discovery to private industry, with exclusive control being granted for 5 years. It also would provide a kickback to the federal agency, provided the patent proved to be a moneymaker. If not licensed after a prearranged period, the patent would automatically revert to the government. Excluded from the bill would be government-owned institutions, such as Argonne National Laboratories, in which the government would retain control of all discoveries.

The bill, called the Small Business Nonprofit Organization Procedures Act, comes in the wake of a new policy adopted on 18 July by the General Services Administration (GSA) that also tries to untangle the system of patent transfers. Known as Institutional Patent Agreements (IPA), these guidelines encourage government agencies to give universities and nonprofit organizations control of their federally financed discoveries (*Science*, 17 March). Such agreements were in common use by federal agencies before 18 July, but each was in a slightly different form. The new GSA rule calls for a single standard.

To get control of patent rights, a research organization with an IPA has to petition the funding agency on a case-by-case basis. The result is often chaotic. Says Doyle: "Rarely have I witnessed a more unfortunate example of over-management by the bureaucracy."

Even getting an IPA can be a problem, according to one federal patent official. "Right now you have three candidates for IPA's stuck in the clearance procedure at HEW. And they may never get it. The agency decides which institutions have technology-transfer capabilities and which ones don't." The bill makes no such distinctions. It says that any university, small business, or nonprofit organization is capable of managing its own invention rights better than the government has been able to do in the past.

Opponents of the bill feel that it goes too far in allowing profit-making firms to benefit from federally financed research. Supporters of the bill, however, say that under the present system, benefits are few and far between. Some researchers supported with federal funds are even reported to shy away from innovative research because of the red tape that comes with a discovery.

Let Rats Move Over: Marsupials Are on the Move

In the continuing search for new and better lab animals, a prime candidate may have been overlooked that literally resides in the backyard of the biomedical community. To wit, the lowly opossum. With its pointed white face, beady black eyes, and long naked tail, it might pass for a very large rat. But alas, you say, it is a marsupial, and unsuited to be a human surrogate.

Not so, says William Jurgelski, a cell biologist at the National Institute of Environmental Health Sciences in Research Triangle Park, N.C. An enthusiast who thinks in practical terms, Jurgelski has formed a Committee for the Establishment of a National Marsupial Center.

Why marsupials? Take the baby opossum. Half-formed, with stubs for hind

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States be sure that they do not have a missile in every hole? Why wouldn't MAP induce the Soviets to build more warheads to target every hole? Moreover, they say that the Soviets may be becoming upset by the idea that in the final stage of the SALT II negotiations, President Carter would suddenly embrace a new strategic program that is big (covering an area the size of Connecticut), expensive ($22 billion to $32 billion), and threatening (further enhancing the U.S. first-strike capability). Obviously, the arguments on both sides will be developed only when a final SALT agreement becomes known and the Administration selects a specific MAP scheme.

One extremely important but little-heeded recommendation is that the premise that U.S. ICBM's will be vulnerable, be reexamined. This view was stated most strongly in a 1976 article in the Harvard journal, *International Security*. It argued that rather than destroying 90 percent of the victim's land-based missiles on a first strike, the Soviet ICBM force with small slips in performance might destroy only 50 percent. The many uncertainties that would bedevil any first use of the ICBM force in such a massive attack may be great enough, the paper argued, to deter one. Obviously, as missile technology becomes more refined, these uncertainties and unknowns will loom larger. But this view has not gained much ground.

Two other policy options, launch on warning and ballistic missile defense, have become part of the absolute accuracy debate. Although neither suggestion has been made formally or received much publicity as yet, both have serious implications.

The United States already has geosynchronous satellites that can sense the heat trails from Soviet missiles as soon as they lift into the upper atmosphere, and so would know within minutes of a Soviet ICBM launch. These satellites are complemented by other systems, notably the distant early warning radars strung across Canada and Alaska. Moreover, research under the mellifluous label of "attack assessment" is refining these capabilities, so that the exact trajectories of the missiles, which silos they come from, and what targets they seem to be headed for could all be instantly made known to military leaders. Perhaps because the technology has come so far, the Carter Administration has regularly hinted that it could, if it wished, solve the U.S. ICBM vulnerability problem by simply announcing that it will launch its land-based missiles if its sensors decide a Soviet ICBM attack is under way.

But while such a policy may rescue the 1054 U.S. ICBM's from destruction, it could sink other stable aspects of the strategic balance. Not only are the early warning satellites vulnerable to attack, but they can be fooled: in one inci-

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legs, and a brain only partially complete, the infant emerges from its mother's birth canal barely one-half inch long. It then wiggles up the mother's belly, searching for a meal. Upon finding a nipple, it begins to nurse. Within a few days its jaws fuse so the infant cannot release the nipple. This "abortion which has learned to survive outside the womb" is a perfect model, says Jurgelski, for problems difficult to study in the pregnant animal. The effect of toxins can be tested. Brain, lung, and immune system development can be closely watched. Limb regeneration can also be studied. The opossum, moreover, has 22 large chromosomes (two or three times the size of a human's) and sex chromosomes that are clearly different under the light microscope.

The problem is rearing marsupials. Shy and eccentric, they need special care to ensure reproduction. In the course of some cancer research, Jurgelski was able to build up a large colony of opossums—but other scientists have not been so successful. Many have abandoned research because of lack of suitable rearing techniques.

The proposed center would be devoted to the breeding, maintenance, and study of more than 100 species of American and Australian marsupials. The kangaroo, koala, wombat, and other large marsupials would be excluded.

Though access to marsupials is now limited, Jurgelski has letters from more than 30 scientists who are willing to work on the center. Even the National Aeronautics and Space Administration is interested. Since the infant opossum stays firmly attached to its mother, NASA scientists believe the opossum may be a good experimental animal for the weightless conditions of space. NASA may put opossums aboard the Space Shuttle.

Second-Guessing the Swedes *OMNI* Style

Is winning the Nobel Prize a matter of politics, personalities, and being in the right place at the right time, or is it a matter of hard work and keeping your nose clean? According to a new stab at the laureate formula appearing in the premier issue of *OMNI*, a slick coffee-table blend of science fact and fiction, it takes a precise proportion of each.

The one-two-three's of walking away with a Nobel are spelled out by William K. Stuckey in an article replete with predictions of the 1978 Nobel Prize winners in physiology/medicine, chemistry, and physics. Stuckey's method draws on interviews conducted over 8 years with a dozen Swedish judges and some 60 Nobel laureates. From the resulting insights into the power politics of Swedish prize selecting, Stuckey rolls bits of sage advice. On visibility, for example, Stuckey says: "To know you is to love you, of course, but the Swedes can't know you if they can't see you. One must be in the right place for that, since Scandinavian vision is extremely narrow. They can't see you, unfortunately, if you've developed your antigravity device at North Dakota or your hyperspatial rejuvenator at Aleutian Polytech."

Stuckey then names high visibility campuses here and abroad, and even predicts where new power centers will spring up. His formula also mixes in tidbits gleaned from the pages of the *Science Citation Index*. But it's not just a numbers game. The most cited scientist of all time, says Stuckey, would be a lousy bet for a Nobel Prize because most of the citations are to a fluke paper that described a cheap and sensitive method for measuring small amounts of protein.

With a little number-juggling, and a bit of hocus-pocus, Stuckey then takes his picks for the 1978 Nobel Prizes. For physiology/medicine, Sweden's Sune Bergstrom and his life-preserving prostaglandins, his understudy Bengt Samuelsson, and "the grand wizzard of the neurotransmitter," Ulf von Euler, will take the award in a Swedish three-way sweep. In chemistry, Harvard's Robert Woodward and Cornell's Roald Hoffman will walk away with the prize. In physics, Arno Penzias and Robert W. Wilson of Bell Labs "should win for their near mystical detection of what is called three-degree radiation, the magical leftover whisper of the Big Bang that started it all."

—William J. Broad