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data transmission by satellite. The Study Group cites development of better experimental techniques as a prime area for close communication between groups of researchers throughout the world. They recommend joint studies of new technology and the joint design and/or construction of regional-project components. —FCB

Ancker-Johnson

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cline. "For example," she said, "in 1963 only about one US patent in every five was granted to a foreign inventor. Today the fraction is nearer to one in three. And the trend is not about to be reversed. In the area of charge-coupled devices, for instance, Americans were far in the lead in the early 1970's, but right now about 30% of the pending patent applications belong to foreign inventors."

Another problem Ancker-Johnson pointed out concerns the steady decline over the last decade in the proportion of our Gross National Product invested in basic research. This and the patent-balance data have been incorporated in the National Science Board's report *Science Indicators 1974* (see PHYSICS TODAY, May 1976, page 93). "However," she added, "President Ford's 1977 budget calls for $24.7 billion for Federal R&D—an increase of 11% over 1976 estimates."

Shorten CoCom list? Since the early 1950's, member nations in NATO (except Iceland) plus Japan have, as the Consultative Group Coordinating Committee, maintained a list of products whose export to Communist countries is to be controlled. The US maintains a separate, even more restrictive list. Two years ago the US Defense Science Board organized a 15-member Task Force on the Export of US Technology, headed by J. Fred Bucy Jr (Texas Instruments). The group examined the findings of its four subcommittees—on airframes, jet-aircraft engines, instrumentation and solid-state devices—and transmitted its recommendations to the Department of Defense.

As a task force member, Ancker-Johnson has identified two major conclusions: Many *products* now being controlled could and should be removed from control, without detriment to the national security and with considerable economic benefit, and the export of advanced technology *per se* should be more carefully controlled. Primary emphasis in US export control, according to the task force, should be placed on so-called "active transfer mechanisms," those activities that most readily teach foreign competitors how to utilize American design and manufacturing know-how in advanced-technology areas. Less scrutiny would be devoted to product sales of low strategic impact, and the CoCom list would be "drastically" shortened. "If we continue to penalize our advanced-technology firms so they're unable to sell abroad the products they should be selling," she said, "they won't have as much income to plow back into R&D . . . ," and the US slump in science and technology will continue.

One controversial aspect of the task force's study is their recommendation that certain transfer mechanisms involving the free movement of persons—such as employment of US citizens as key manufacturing consultants in Communist nations, or the training of students from Communist countries at academic institutions and labs in the US—need to be brought under better control. Maybe there are some means, according to Ancker-Johnson, by which technology is transferred inadvertently by the US but very much according to the plans of Communist nations. But she thinks an unjustified emphasis has been placed on the task force's contemplation of restrictive measures, when in fact the group's findings "barely mention" them.

Science advice. Very few people not involved in the Federal political process, according to Ancker-Johnson, realize what a risk President Gerald Ford took in asking the Congress for a statutorily based science-advisory apparatus in the Executive Office of the President. "It takes guts for a President to go to a Congress controlled by the opposing party" with such a request, she told us, because "all sorts of tinkering can go on, once the legislators get it." An important fact, she said, is that the new White House Office includes the word *policy* in its name, "and that's no accident. The President's expectation for this office is that *every* issue that is affected in any way by science and technology will receive an input from the OSTP. And you try to think of any current national issue that is not affected by science and technology today!" —FCB

Questions awaiting the worldwide accelerator

The Serpukhov study group outlined some of the unanswered questions in high-energy physics and identified the special capabilities of each type of projected accelerator.

Among the key questions, the group said, are: "Do quarks exist and, if so, how are they confined in hadrons, and what are the forces between them? The recent results about hadron collision products that possess high transverse momentum have shown how little we understand about the internal dynamics of hadrons. Secondly, is the Weinberg–Salam gauge theory of weak interaction pointing towards the real solution or is it a wrong approach? The quantitative agreement of neutral-current data with theory is strong encouragement for gauge theories. Nevertheless, no deviations from a four-fermion structure of the weak force have yet been observed."

For weak interactions, it is expected that at about 1000 GeV (center-of-mass system) the simple four-fermion theory will break down. There might be a whole series of intermediate bosons, Higgs bosons of different kinds and a series of heavy leptons and neutrinos.

For strong interactions, there is no indication of a definite critical energy range. One would like to know whether or not further quantum numbers exist, such as charm, flavor, color and so on.

The accelerators and storage rings being discussed for the VBA each have their advantages:

- Proton–proton and proton–antiproton storage rings, which reach the highest practicable center-of-mass energies at the price of lower luminosity, appear adequate for finding the weak-interaction intermediate bosons, provided the Drell–Yan production model can be applied. In studying strong interactions, total cross sections and energy dependence of particle-production mechanisms will be probed in a significant way.
- The importance of conventional proton synchrotrons is in their higher luminosity, diversity of external beams and the opportunity to use nuclear targets.
- Electron–positron colliding beams allow the clean study, not only of quantum electrodynamics and electromagnetic production of hadrons, but of weak interactions as well. In addition any charged heavy leptons or other charged non-hadronic pairs (including intermediate bosons) would be produced at a measurable rate, if they exist.
- Electron–proton rings permit the clean study of strong interactions at small distances. They can test the idea that the strong interactions weaken at small distances and grow at large ones (asymptotic freedom). One can study the nature of proton constituents and how (or whether) they are confined. Finally, heavy leptons might be produced (if they exist).

in brief

The main building of the Rutgers University physics department has been named the Serin Physics Laboratory, in honor of Bernard Serin, who died in 1974. Serin was best known for his work in superconductivity and had been a member of the Rutgers faculty for 26 years.

Reviews of Data on Science Resources, No. 25, "Doctoral Scientists and Engineers in Private Industry, 1973" (NSF 76-302) is available from the Superintendent of Documents, Washington, D.C. 20402 at $0.35 per copy.

The (British) Institute of Physics has recently purchased Adam Hilger Ltd, a publisher of scientific, technical and medical books. □