Like Thomas Longstreth of the Federation of American Scientists, another critic of the B-1 program, Meyer notes that the quality of the penetrating bomber will become more important if the United States and the Soviet Union agree to new ballistic missile limits.

What lessons can be drawn from the record of the B-1B? General Harbour stresses two narrow points. He says the Air Force should have described the terms of its "contract" with the Congress more carefully, making it clear that the promised initial operating capability did not mean that planes would be "full-up" in 1986. Second, he concedes that the Air Force underestimated the task confronting the builder of the radar jamming system, the Eaton Corporation's AIL Division in Deer Park, New York, and overestimated the company's ability. For example, specialized parts had to be built from scratch because a commercial supplier did not want to invest in equipment for a one-time surge in demand. There were many unanticipated problems like this. (Eaton was so shaken by this experience that it has put all of its defense electronics subsidiaries up for sale. So far, it has received no offers.)

Aspin reached other conclusions. The most important lesson, according to the House Armed Services Committee, is that quality suffers if weapons are rushed into "concurrent" development and production schedules. Aspin's investigation discovered, for example, that the development and production contracts for the radar jammer were signed on the same day. This helped save money at first, but may cost more in the long run.

The second lesson the committee cited was that the military needs a lot of help and supervision in spending its money—a self-serving point for Congress. The Air Force was its own prime contractor on the B-1B. The committee decided that the military does not have enough experience or continuity to take on tasks of this kind. General Harbour disagrees, saying that the problems with the B-1B were material, not managerial, and that no private contractor would have done better. Congress nevertheless will remedy the problem by adding a new level of management, its own, demanding bimonthly technical reviews on the B-1B.

In a broader context, there may be no managerial formula for building weapons well. The quick production, fixed-price approach used in this case certainly did not bring good results. A final lesson may be that any machine with as many purposes and as many designers as the B-1B has had will fall short of expectations. ■

ELIOT MARSHALL

Foreign Engineers on Rise

U.S. engineering schools attract their share of the best and brightest to their graduate programs, but about half are drawn from other countries. Academically talented U.S.-born students tend to opt for financially more attractive jobs in industry rather than pursuing research degrees. A new report* sponsored by the National Academy of Engineering examines these trends as part of an effort to identify issues raised by the "increasing prevalence of foreign-born engineers in our society."

Foreign-born engineers are playing an increasingly significant role in American industry, but their impact so far has been even greater on academe, particularly on engineering graduate programs and faculty. Nearly 50% of newly awarded doctorates in engineering go to foreign-born engineers. In 1985, almost two-thirds of engineering postdoctoral posts were occupied by noncitizens.

The future role of foreign-born engineers in the engineering professariat is already staked out. The proportion of noncitizens among engineering assistant professors younger than 35 years increased from 10% in 1972 to 50–55% by 1985. About three-quarters of these noncitizens have applied for U.S. citizenship. U.S. engineering education, therefore, seems to have become a way to qualify for naturalization and for desirable jobs for a select group of well-educated immigrants.

Some 90% of engineering undergraduates still are U.S.-born, but relatively few pursue graduate studies. The report says "one reason for this dearth of U.S. applicants has been the lure of immediate employment at attractive salaries. To overcome this barrier, we recommend the establishment of well-paying graduate fellowships in engineering for U.S. citizens with stipends that would be (nearly) competitive with attractive opportunities for immediate industrial employment."

Stanford S. Penner of the University of California, San Diego, who chaired the group that produced the report, described foreign applicants to U.S. engineering schools as "absolutely the cream of the crop," and noted that the infusion of their talent is a "terrific economic bargain for this country," since most have completed undergraduate engineering training in their own countries.

The report, however, raises concerns about the effects on U.S. engineering education of the growing involvement of the foreign-born as faculty and as teaching and research assistants. The most widely cited problem is the lack of proficiency in English of many of those in teaching roles. Concern has also been expressed that cultural differences may be reflected in attitudes of some foreign-born engineers that discourage women and minorities from pursuing engineering studies.

In addition, national security and export control regulations not only create barriers to employment of foreign engineers in sensitive jobs but also complicate collaborative research by defense industries and national laboratories with university departments that have noncitizen students and faculty members.

Has the influx of foreign engineers resulted in the displacement of U.S. engineers or the lowering of salaries? Penner acknowledged that definitive information on the issues is lacking, but the report says that available data indicate that U.S.-born engineers "have not faced appreciably diminished opportunities in industry."

In making its recommendations, the panel took the pragmatic view that, "without the use of noncitizen and foreign-born engineers, both research universities and industries would have difficulties in handling the educational, research, development, and technological programs that are currently supported. This must be realized in any governmental considerations to limit the inflow of foreign engineering students or graduate engineers."

The report says that the underrepresentation of U.S.-born students in engineering graduate education "clearly reflects faulty policies and serious deficiencies in the U.S. educational and value systems." The long-term solution it urges is "a significant improvement in our entire educational system, from kindergarten through college." Its major short-term recommendation—for an increase in stipends for talented U.S.-born engineering graduate students—is addressed to the federal science agencies which provide most of such funds. What the panel is asking, in effect, is that the market forces that produced pay differentials for engineering faculty work for their grad students as well. ■ JOHN WALSH

*Foreign and Foreign-Born Engineers in the United States: Infusing Talent, Raising Issues."