ness, and makes little sense if the technologies are available elsewhere, the committee notes.

Compounding the problem is the fact that delays in obtaining approval can be inordinate. The Commerce Department says it takes, on average, 25 days to process a license; a survey of companies conducted by the committee found a 6-week average processing time. Moreover, about 5% of applications take longer than 100 days to be processed, the committee reports. In contrast, Japan's Ministry of International Trade and Industry "usually responds within 2 or 3 days to applications for exports to Free World destinations."

These impediments have already had a negative impact on U.S. companies' competitiveness, the committee said. In a survey conducted for the committee, 52% of 170 respondents said they had lost sales primarily as a consequence of export controls, and 38% said existing customers have expressed a preference to shift to non-U.S. suppliers to avoid getting entangled with U.S. controls.

The committee in effect argues that the Reagan Administration has veered too sharply toward national security goals in setting export control policies and has not paid enough attention to their economic impact. "The government has not effectively listened to business," says Allen.

This is partly a consequence of the fact that DOD has become the dominant player within the Administration on export control matters. Early on, largely because of Perle's concerns about technology leakage to the Soviets, DOD pressed for stricter controls and greatly increased the resources it devotes to controlling technology exports. In fact, DOD has acquired "de facto veto authority" over some aspects of export licensing, the Academy committee contends, and it dominates U.S. input into CoCom.

To help bring other considerations into export control policy, the committee calls for increasing the resources and influence of the Commerce and State departments, and says the National Security Council should balance competing interests. The committee also notes that within DOD, responsibility for export controls has shifted from the office responsible for research and engineering to the office responsible for policy, where a new bureaucracy, the Defense Technology Security Administration, has been established under Bryen's purview. "It should now be the goal . . . to reestablish a major role for the technical side of DOD and to reduce the DOD role in detailed license review," says the committee.

Perle and Bryen were evidently right to be concerned about the threat to their turf. ■

COLIN NORMAN

Shuttle Plan Faulted

Design changes being made today will determine how the space shuttle performs in February 1988, when it is supposed to blast off again after a 2-year operational shutdown. The overhaul should make the shuttle safer and more reliable. But critical reviews issued on 13 and 15 January by the National Research Council (contracting arm of the National Academies of Science and Engineering) suggest that major obstacles may block the road to the launch pad. It may be unrealistic to expect the shuttle to fly in a year.

The National Aeronautics and Space Administration (NASA), which pays for this criticism, has given no formal response. A spokesman says NASA "will carefully consider all of the recommendations," adding that "nothing has come up that would keep us from meeting the February 1988 launch date."

Overhauling a system as complex as the shuttle can introduce many unexpected risks. One hazard, the NRC reviewers point out, is that redesigners will assume they understand the original system when they do not. They may make "improvements" as troublesome as the flaws they remove.

For this reason, the NRC reviewers urge NASA to move slowly, methodically, and with more attention to test data. A number of recommendations deal with design and testing fundamentals.

A major concern is that NASA appears to be moving on a "success-oriented" path that "leaves little room in the schedule for modifying the design." This may set a bias against identifying new problems, making it hard to anticipate trouble. This comment comes from an 11-member committee looking into problems in the solid rockets, chaired by former National Science Foundation chief H. Guyford Stever.

The Stever report, the third in a series that will continue through the shuttle's first launch, stresses the need for contingency planning. It urges NASA to develop alternative technologies in several key areas, so that if a planned design change does not work, NASA will have a second option to fall back on. Connected to this is another fundamental recommendation: that NASA make testing procedures more coherent. The reviewers say that some tests appear so ill conceived that they may not clearly signal a failure when one occurs. The effect may be to let intuition and inertia drive the program.

As an example, the Stever committee focuses on the rocket nozzle and its attachments. This is one of three items cited as not covered by adequate contingency planning. The others are the redesign of the joint between rocket casings (called the "case field joint") and the configuration of insulation around all the joints, including the infamous O-rings. The nozzle had problems before; now they are likely to become more complex.

According to Myron Uman, staff director for the Stever Committee, new problems may be introduced because NASA wants to strengthen the joint at the nozzle by installing 100 radial bolts. There are already scores of axial bolts in place. Stress patterns and leakage risks will be made more complex by doubling the number of bolts, adding bolts in a new orientation, putting in extra holes, and installing small O-rings in each bolt hole. It would be simpler to cast a metal forging for the nozzle. But that would take more time and perhaps more money. NASA thinks it can make the existing nozzle work. The Stever panel finds the lack of an alternative design "serious, since the joint is critical for safety, few tests of the final configuration are planned, and they occur late in the test program."

The group also examines the O-rings in detail. After making a fundamental error in selecting materials for a new O-ring design, NASA decided to stick with old materials. A heating system will be added to keep the O-rings soft in cold weather. But the Stever group notes that this will introduce the new risk of having too much heat.

In the same week that this report came out, another committee headed by Alton Slay issued comments on NASA's risk analysis techniques. Although low-keyed, it also stresses fundamentals. In particular, it urges NASA to use numerical analysis to separate big risks from little ones. In setting priorities, the panel notes, NASA does not "consider the probability of occurrence of an event," but relies too much on the "judgment of experienced practitioners." ■ ELIOT MARSHALL