

portance. It was not apparent to many as late as 1955 that protective construction had become a vital area for military research. The relevant areas change as we make progress, and one of the most important tasks of research and development management is to spot the new areas and to get good work in them started promptly.

b. Dividing the budget among what we have called weapon system development, component development, exploratory development, and basic research. The division between the last two and the first two depends to a large extent on our time preferences. If we attach importance to future decades, we had better allocate substantial sums to basic research and exploratory development and protect them as well as we can from raids by officials who have pressing and immediate operational responsibilities.

c. Selecting the critical components — the gyroscopes, the computing equipment, the nose cones, the infra-red sensors, the rocket engines, and so on — on which the success of future weapon systems is likely to depend, and making sure that there is an adequate program for the development of each — with plenty of duplication and competition — either within weapon system development projects or independent of them.

d. Finally, selecting good weapon systems for the fabrication of prototypes.

ECONOMIC CALCULUS IN PLANNING RESEARCH AND DEVELOPMENT

We have already indicated that the kind of explicit economic calculus illustrated in Chapter 8, at least in its present state, is of only limited use in planning research and development. Uncertainties, incommensurables, and intangibles dominate many problems. Nevertheless, economic analysis can serve a useful function both in selecting development projects and in planning them.

1. *In estimating the utility of developments.* In military problems we can sometimes place an approximate valuation on the worth of research in relation to expenditures on procurement and operations. As an example from the past, how much was it worth to develop the B-52? As a first approximation, the amount we would have had to spend on additional B-47's, tankers, bases, and so on, to give us the same strategic offensive capability without B-52's in the force that we would have with them. A calculation of precisely this kind was made in Chapter 8, where it was estimated that the development of the hypothetical HC-500 and HC-600 aircraft had been worth about \$600 millions. How much would it be worth to develop a lighter-weight structural material for aircraft and missiles? In only one use, strategic air, it would be worth the savings in tankers and overseas bases now needed to extend the range of our