

2. There should be more duplication, the greater the uncertainties. If, in developing a missile, the airframe is straightforward engineering, while there appear to be great uncertainties in developing the guidance, the important thing is to try several approaches to the guidance problem — perhaps completely independent approaches using competing contractors.

3. There should be more duplication, the cheaper it is to duplicate. More weapon systems should be developed than are ultimately procured (it may have made sense to develop two intermediate-range ballistic missiles — Thor by the Air Force and Jupiter by the Army — yet not to buy quantities of both for operational use). There should be more duplication in the development of difficult or critical components than in the development of whole weapon systems. And there should be most duplication in exploratory development and research, where the cost of trying another path or testing it is usually a tiny fraction of prototype fabrication costs.

As a result of factors (2) and (3), we want a great deal of “temporary” duplication. Later, as we get more information and reach more expensive stages of development, we want to decrease the number of routes to be followed.

4. There is a stronger case for duplication if the alternatives are qualitatively different, and if the factors that will determine their success or failure are independent.

TOO LITTLE COMPETITION

This is not quite the same thing as too little duplication, although the two are closely related in practice. Duplication is possible without competition — for example, if the multiple paths are explored by the same organization or individual. And competition is possible without duplication. (The Army and Navy would compete for budget even if they never developed similar kinds of hardware.) Competition provides a spur that is frequently lacking in the research and development world of cost-plus contracts and scheduled progress. Some dedicated individual researchers do not require it, but there is nothing so stimulating to most people and organizations engaged in research and development as the fear that another company or laboratory will beat it to the objective.⁹ Even competition among the military Services has proved highly beneficial. Robert Schlaifer concluded as follows from his study of the development of aircraft engines:

The American system of administering development did, however, have one feature greatly superior to both the British and the German systems. This was

⁹ It helps significantly if some real monetary prize is awarded the winner — like a production contract.