REFORM IN DEFENSE ACQUISITION POLICIES:
A DIFFERENT VIEW

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The following paper, originally published as a "Viewpoint" article in *Aviation Week & Space Technology*, takes issue with those in the Defense community who suggest that the way to achieve low cost production of defense hardware is for the government to commit itself to stable, long-term purchases of the kind that would exploit the efficiency of the traditional production line, which is set up to produce a single design, in large quantities, over long periods of time. In short, they recommend that the Congress, DoD and the Armed Service buyers should reform their acquisition policies to conform to the kind of inflexible production line that reached maturity decades ago and is still typical of defense industry.

Our view is quite different. We believe that what is needed is not marginal improvements in the way hardware is funded and contracted for, but a breakthrough in the way it is produced. And such a breakthrough is promised by the emerging flexible manufacturing technologies. Therefore, the means of production rather than the buyer is now the appropriate focus for reforms in defense acquisition policy.

REFORM IN DEFENSE ACQUISITION POLICIES: A DIFFERENT VIEW

Many of the most serious and vexing problems in the Defense Department's purchase of weapons and support systems are the consequence of a growing mismatch between the changing needs of today's defense buyers and an obsolescent production culture suited more to the 1940s than the 1980s.

Today the acquisition agencies of the armed services are committed to quality rather than quantity, to procurement flexibility rather than to rigidity. The services want to develop defense systems embodying superior technology, to field them quickly so as to secure the full advantage of superiority, to update them promptly to respond to new threats and technological opportunities, to keep investment and support costs affordable, and to do all this while retaining flexibility of demand, that is, flexibility to change production rates and the size of annual buys yearly or more often. In pursuing these objectives, the service buyers are inhibited by a traditional production culture consisting partly of a particular kind of production plant, and partly of a deeply ingrained set of attitudes on the part of both buyers and producers.

Today's defense manufacturing technology is still characterized by the kind of inflexible production line, pioneered by Henry Ford, that reached maturity in World War II. This production line is set up to produce a single design, in large quantities, over long periods of time. Although production lines have been progressively automated since 1960, the kind of automation adopted in the defense sector has done little to increase flexibility, and the procurement culture seems to have changed relatively little. Both the government buyer and the producing contractor continue to regard the specialized, optimized production line, designed for high rates of output, as the norm.

This mind set is pervasive. It seems to have become firmly established among those economists, lawyers, physical scientists and R&D engineers who formulate procurement policy, and even among those who study the problems of defense acquisition. Thus recommendations
designed to improve the defense acquisition process have almost always aimed at modifying the behavior of the buyer. There has been a long succession of buyer-focused recommendations implicitly based on the assumption that efficiency is to be achieved through the use of an inflexible manufacturing technology producing fixed designs in large quantities.

Although this assumption persists, almost everything else has changed. For many decades, the American way of war was to out-produce the enemy--to overwhelm him with materiel and the firepower it could bring to bear. But since the 1960s our basic defense strategy has undergone a fundamental revolution. In nonnuclear war, we now aim to fight outnumbered and win. We rely primarily on relatively small, well-trained forces employing weapon, support, and control systems of superior quality. This shift from quantity to quality means that we must strive to develop superior designs before our adversaries do, and then quickly embody these superior designs in our deployed forces.

These requirements for flexibility are reflected in the acquisition process. To exploit technological advances or respond to progressively changing threats, design changes occur frequently even after production has begun, and concurrency between the development and production phases of the acquisition cycle is a fact of life. Indeed, development and modification are continuing activities throughout the lifetime of a weapon system, and development costs are sometimes as substantial after production has begun as before.

As a consequence, the 1980s defense buyer is asking for something very different from what he asked for during the 40s, 50s and 60s. Then he bought thousands of units a year (aircraft, for example); unit costs were relatively low; and designs were relatively simple and stable. Today he buys hundreds or perhaps only tens of units a year; unit costs are much higher; designs are complex; and change is almost a continuous activity. In addition, the number of units of a particular system programmed for purchase for a given fiscal year is frequently changed (usually for good reason) by the Congress, the DoD or the service itself, and these changes in the "buy size" occur repeatedly, both in the planning years before the production contracts are let, and subsequently during the lifetime of the successive contracts.
It is now most unusual for a major system to display a smooth production rate curve plotted against time. Rather than rising smoothly to full rate, remaining there for a number of years, and then gracefully phasing down, such curves are typically jagged, rising or falling sharply in response to changing perceptions of need. The full, planned production rate (for which the production line was designed to be efficient) is seldom achieved or, if achieved, rarely long maintained. Typically, what happens is that the production period is stretched out, the production rate is too low to be economic (some aircraft, for example, have been produced at rates of less than one or two a month), the unit price rises higher than originally planned for, deployment is slowed, and the total number deployed is less than that called for in the originally perceived force requirement. No major Air Force program has been procured to the original plan since 1969, and the other services display no greater stability.

In short, the defense producer today is generally a small-lot producer responding to an unstable demand and almost always producing at less than the economic rate for which his production facilities were set up. It is not surprising, therefore, that procurement prices are high, and that the learning-curve price reductions, expected on the basis of former cost-quantity experience, have seldom been achieved in recent years, except possibly for aircraft engines.

Unfortunately, most of the reforms proposed to alleviate these conditions focus on persuading the buyer to ask, not for what he believes he needs, but for what the traditional production culture could provide.

Consider the 32 acquisition improvement initiatives introduced by the Defense Department in 1981. At least a third of these initiatives are designed to achieve production stability, either by enforcing stable program funding, or by avoiding frequent design changes. Measures for achieving stable funding include better coordination of program milestones and the budgeting process; improving cost estimates; budgeting to most likely costs; and multiyear contracting. Measures for avoiding frequent design changes during production include a more evolutionary and incremental approach to system development; pre-planned
product improvement; greater use of standardized, off-the-shelf components; more generous funding of subsystem and system test articles; and, in general, completing the development process before production begins.

If the prevailing production technology is regarded as given, initiatives of this kind, aimed at reducing the buyer's flexibility, may well be the best way to try to improve production efficiency and control procurement costs. But most of these initiatives are not new, and similar attempts, repeated under successive administrations, have achieved only modest results. We can see no reason to expect greater success in the future.

On the contrary, we are convinced that such attempts will be counterproductive in the long run, because the underlying need for procurement flexibility is real and will persist. Indeed, for the 1990s and beyond, demand uncertainties are likely to become even greater, driven by the multiplicity of plausible conflict scenarios in a multipolar world, the worldwide proliferation of modern arms, the changing Soviet and regional threats, and the continuation of intense competition among rival acquisition programs for their share of the defense budget. Proposals and initiatives that attempt to constrain the developer, producer and defense buyer to achieve production efficiency through large, stable buys produced on inflexible and obsolescent production lines are likely to have only marginal success at best. And they will inhibit efforts to exploit the critical advantage the United States possesses in its ability to outpace its adversaries in design improvements.

What is needed is not a marginal improvement in the way defense hardware is funded and contracted for, but a breakthrough in the way it is produced. And this breakthrough is in sight. "Flexible manufacturing" based on the exploitation of computer technology may provide both the efficiency and the flexibility required for defense production in the 1980s and beyond. It also promises better data management, shortened production flow times, more intensive use of plant, rapid expansion of production during emergencies and improved quality control.
We suggest, therefore, that the producer rather than the buyer is now the appropriate focus for any serious attempt at acquisition reform. The rapid advances being made in computer-integrated flexible manufacturing systems have the potential for controlling unit costs without sacrificing progressive improvements in equipment design. Flexibility in production is the ability to manufacture efficiently a changing variety of products in a given production facility, a facility that is set up to operate with the efficiency traditionally associated with mass production but without the need either to standardize on a single design, or to produce that particular design in large numbers, or to maintain a high and stable rate of production for that design.

The ability to manufacture efficiently a changing variety of products implies two different but related things: first, efficiency in manufacturing various mixes of products of fixed design, and, second, efficiency in manufacturing a given product when its design is changing over time. The latter is particularly important during the period when an item is being first produced and, as a result of operational testing, changes are being made in the item's design; but it is also important later in production, when design changes are made to modernize a system or to adapt it to a new threat.

Automation as such does not lead directly to flexibility in production. On the contrary, much automation has been inflexible, and displays less adaptability than old-fashioned production lines that relied heavily on skilled labor. Advances in computers, however, and their on-line availability appear to make flexible automation increasingly feasible. What was an attractive speculation 10 years ago is now in part already realized. A number of highly successful flexible manufacturing systems are already in operation, but they produce mainly at the component or subsystem level. The complete computer-integrated production system producing complex end items probably hasn't arrived yet; although Deere & Co. in this country, Honda in Japan and MBG in Germany (to name only a few of the leaders) have recently made major advances. Thus more and more complicated items are being produced by flexible manufacturing systems, and it appears to be only a matter of time--possibly only a few years--until most if not all the operations of
fabrication and inspection could be handled by flexible computer-integrated automation, as well as much of the assembly operations.

Thus both flexibility and efficiency in defense production appear achievable. There is an urgent need for a thorough and objective examination of what has already been achieved in this direction, together with an assessment of the prospects for the future. If, as we foresee, the prospects are favorable, then a shift to flexible manufacturing methods should be sought as a specific, high-priority objective of U.S. defense acquisition—and industrial—policy. This will require major policy changes, emphasizing not the buyer's stability in funding and contracting for a particular defense system, but the incentives required to modernize an outdated procurement culture and stimulate the plant investment required for the widespread adoption of flexible manufacturing systems among both prime- and sub-contractors in the defense sector.