RECONSTITUTING A PRODUCTION CAPABILITY

PAST EXPERIENCE, RESTART CRITERIA, AND SUGGESTED POLICIES

JOHN BIRKLER / JOSEPH LARGE / GILES SMITH / FRED TIMSON

National Defense Research Institute

Prepared for the Under Secretary of Defense for Acquisition

RAND

The research described in this report was sponsored by the Under Secretary of Defense for Acquisition. The research was conducted in the National Defense Research Institute, RAND's federally funded research and development center supported by the Office of the Secretary of Defense and the Joint Staff, Contract MDA903-90-C-0004.

Library of Congress Cataloging in Publication Data

Reconstituting a production capability : past experience, restart criteria, and suggested policies / John Birkler ... [et al.].
p. cm.
"Prepared for the Under Secretary of Defense for Acquisition."
"MR-273-ACQ."
Includes bibliographical references.
ISBN 0-8330-1445-5
1. Industrial mobilization—United States. 2. Defense industries —United States. 3. United States—Armed Forces—Procurement. 4. United States—Armed Forces—Weapons systems. I. Birkler, J.L., 1944– . II. United States. Office of the Under Secretary of Defense, Acquisition.
UA18.U5R37 1993
355.2'6'0973—dc20 93-29793
CIP

Published 1993 by RAND
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
To obtain information about RAND studies or to order documents, call Distribution Services, (310) 451-7002

SUMMARY

With the transition to lower U.S. military force levels, near-term reductions in defense procurement seem inevitable. Budget pressures will dictate not only that smaller quantities of individual weapon systems be acquired but also that many long-enduring production lines be shut down. In addition, production lines of new weapon systems may well be dismantled soon after the initial production runs are complete.

At the same time, the United States must maintain a capability to respond to regional conflicts that threaten U.S. interests and to reconstitute its forces in the event of extended conflicts. Indeed, reconstitution is one of the four foundations of the new national military strategy enunciated by President George Bush in 1990.

In this report, we examine one promising reconstitution option: activating the industrial base to produce major weapon systems whose production lines have been shut down. This report examines the following major production-restart issues: cost and schedule relative to those of new programs, measures to ameliorate the problems of restart, criteria for selecting restart candidates, and alternative reconstitution strategies. The specific questions we set out to answer and the conclusions we reached are as follows.

WHAT DOES EXPERIENCE SHOW REGARDING THE SCHEDULE AND COST OF RESTART COMPARED WITH THOSE OF ORIGINAL PRODUCTION?

Current acquisition practices include a demonstration and validation phase, prototypes, and extensive risk-reduction activities, which cumulatively could stretch an "all-new" acquisition program out to ten years. We obtained data for 11 aircraft programs that were shut down and restarted or for which restart was seriously considered. We found that, beginning from the time the production contract is signed, it takes about one or two years less to produce the first unit for restarted production than for original production. This is a very conservative estimate of restart's schedule advantage, because, in a restart program, an entire support network—maintenance personnel, spares, manuals, special test equipment, etc.—is already in place. That network, together with previous experience in testing the system, should result in a savings of many years in achieving a force with operational readiness equal to that resulting from original production. Furthermore, restarting production of an item that is already in service presents a very low risk compared with developing and producing a new system.

In addition to its schedule advantage, restart has a cost advantage. On average, the initial restart unit requires only about 10 percent of the one-time (nonrecurring) labor input that the initial original-production unit needs. As for recurring costs, the first restart-production units require approximately half as much production and quality-assurance labor and only about 40 percent of the tooling labor and 20 percent of the engineering labor as the original first unit. In virtually all the programs we examined, however, restart production experienced a learning curve with a shallower slope than that of original production. That is, the reduction in labor input with each succeeding unit was less on a percentage basis for restart than for original production.

The data and analyses presented in this study clearly and consistently indicate that restarting aircraft programs that have previously achieved full-production capability and then been shut down should result in follow-on programs that require less time from program start to first delivery and should be significantly less expensive than the original program.

WHAT ACTIONS SHOULD BE TAKEN AT SHUTDOWN TO FACILITATE EFFICIENT RESTART?

Ensuring that restart's time and schedule advantages are realized may require that certain actions be taken when a production line is shut down that would not be taken otherwise. Interviews with airframe, missile, and other major weapon-system contractors reveal general agreement on the elements of "smart shutdown." Certain physical assets, data, and know-how were identified and agreed to as being essential to a smooth restart by virtually all contractors interviewed.

The investment required to preserve the essential items is quite modest compared with the original acquisition cost, and a very modest dollar investment at shutdown could save hundreds of millions of dollars in the event restart is required. Contractors, however, have little incentive to incur even modest costs for storing important items, some of which may be bulky and useless until restart gets under way, if it ever does.

To ensure smart shutdown, DoD should fund contractor efforts to preserve those documents, tools, etc., that are needed to restart production. As part of this process, videotapes and photographs of fabrication and assembly activities should be made, not only to record how the system was produced but to serve as training aids for follow-on workers. Interviews with key shop and technical personnel should be part of such documentation. The preservation activity need not be expensive; indeed, it can cost less than routine disposal of tools in accordance with government regulations.

The key to the effectiveness of this technique is the thoroughness with which shutdown activities render paper and hardware ready for reuse by an entirely new set of people with minimal confusion at the time of restart years later.

HOW SHOULD RESTART CANDIDATES BE SELECTED?

In an era of declining resources, DoD should not spend even modest extra sums in shutting down production for systems unlikely to be restarted. To aid DoD in avoiding such expenditures, we sought answers to the following questions: How should DoD go about

identifying possible restart candidates? Would most systems have to be put through restart-facilitating shutdown? Can useful generalizations be made about restart candidates?

We identified several criteria that weapon systems currently in procurement should satisfy if they are to be considered candidates for restart:

- Is the production run complete or nearing its end?
- Is the system likely to suffer significant losses or consumption during future conflict? Frontline systems such as fighter aircraft are more likely to require force reconstitution.
- Is it difficult to identify deployed or programmed systems that could substitute operationally?
- Is it practical to restart production? For example, could units be available soon enough? Would they have sufficient operational life prior to obsolescence?

For illustrative purposes, we applied the first three criteria to 115 weapon systems across all military services. Only 30 percent were identified as potential candidates for restart. Our intent here was not to recommend specific restart candidates; the list that DoD eventually develops with its own expertise would probably be different from ours, but we doubt it would be much longer. Application of the fourth criterion—too situation-specific for us to apply—would reduce the list further. The decision to restart would occur at some time in the future and would depend on projected military requirements at the time. Thus, the modest costs of efficient shutdown need only be incurred for a minority of systems.

Such systems are likely to be those requiring relatively large investments in production resources (plant, tooling, etc.) and involving long industrial lead times (several years from order placement to delivery). This class of systems poses the most difficult planning challenges in reaching a compromise between near-term economy and long-term capability to meet force needs that are not now programmed.

WHAT ALTERNATIVES TO PRODUCTION RESTART MIGHT BE USEFUL?

Production restart is only one of several possible strategies for supporting reconstitution of forces. Two additional options that might be applied to either current or future weapon systems are

- Maintaining production at a very low rate, possibly deferring satisfaction of immediate needs in return for sustaining an active production line over a longer period of time
- Producing at a high (efficient) rate beyond immediate needs and storing the excess for use in future contingencies.

Each strategy involves a different balance between near-term costs (which might be one-time or recurring) and the time and cost required for producing additional quantities of an item in the future. Each should be the subject of additional research, including examination of cost and schedule consequences across weapon system types and a range of scenarios.

CAVEATS

In interpreting and acting on our results, three important caveats must be kept in mind.

First, *our database is limited to a few types of systems.* Only a very limited number of programs have undergone a restart, and in those only very limited steps were taken at the time of shutdown to facilitate restart.

Second, *we have no information on the practicality of restarting production of an item when the original developer and producer are no longer available.* Anecdotal evidence suggests that restart in that situation would still be possible, but time, cost, and risk parameters remain outside our experience and are speculative.

Third, *our experience is limited to situations in which an adequate body of trained, or readily trainable, manufacturing workers can be hired.* If a whole industry, such as aircraft or ship fabrication and assembly, falls into serious decline and a generation of skilled workers is allowed to disperse, restarting a production line might be less

practical than recent experience indicates. Of course, under such circumstances, starting a new program may be even more daunting.