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Arsenal of Democracy in the Face of Change: Economic Policy for Industrial Mobilization in the 1990s

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**ARSENAL OF DEMOCRACY IN THE FACE OF CHANGE: ECONOMIC POLICY
FOR INDUSTRIAL MOBILIZATION IN THE 1990s**

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PREFACE

This report summarizes the results of a larger study effort carried out by a research team at the Oak Ridge National Laboratory for the Federal Emergency Management Agency. Individual participants and their contributions are recognized within the text. In the course of carrying out this work, the study team benefited from the advice and counsel of many experts in the field of national defense, surge and mobilization planning, and DOD policies and procedures. While those who contributed so freely to our work are too numerous to mention individually, we are in their debt.

David J. Bjornstad, ORNL Principal Investigator

EXECUTIVE SUMMARY

Does the U.S. possess the economic capability to produce conventional weapons in sufficient quantity and quality to compensate for the impending reduced strategic nuclear deterrent? Have changing economic conditions--domestic and worldwide--changed this ability? Are there policies that would enhance this ability in the face of economic change? In each case, the simple answer appears to be yes--but there is a much more complex story to tell.

The capability to produce conventional weaponry today is more important than in the past. Nuclear parity and arms limitations agreements have and will continue to place additional reliance on conventional weaponry as a deterrent to major conflicts. It is also more difficult to produce conventional weapons than in the past. Modern non-nuclear weaponry is increasingly sophisticated, evolves rapidly, and becomes obsolete rapidly. Current strategy calls for continued modernization rather than maintenance of large weapon inventories. The nation implicitly relies on the ability to surge and/or mobilize production to meet the needs of a military buildup.

*The nation best remembers the WW II buildup. Since WW II many economic changes have occurred in the domestic U.S. economy and in its relationship with the rest of the world. Studies by many others have argued that matching the achievements of the economy during that period--when the U.S. was **The Arsenal of Democracy**--would be difficult, if not impossible. Data show, however, that the WW II build-up occurred more slowly than many suppose and with such economic stimulus by government that virtually all the costs of fighting were paid for out of economic growth.*

This study addresses seven issues raised by past studies:

- *How should the Federal Government organize information and plan for a military build-up?*
- *What plans and procedures should support surging selected weapons production?*
- *What plans and procedures should support full or total mobilization?*
- *What fundamental national economic planning should support the defense effort?*
- *How should the nation deal with vulnerability due to offshore sourcing?*
- *How can the acquisition system be improved?*
- *How should defense technologies be supported and produced?*

There are no simple answers to such difficult questions, but there are guidelines that could contribute to solutions.

We find that a surge/mobilization planning framework should meet two criteria: 1) it should focus attention at the proper economic units--the firms, economic sectors, or the economy as a whole; and 2) it should provide a forum for agencies of government with diverse interests to articulate their positions and present evidence. National policies concerning an economic buildup should be largely concerned with national economic health and the impacts of current policies on defense; sectoral policies should seek to mold economic capability, should the need for a buildup occur; and firm policies should focus narrowly on particular defense goals and provide firms with positive economic incentives to perform.

We find that the ability to surge is more a matter of policy choices than ability. The technology now exists to gather surge-related information in a computerized environment, make choices as to needed investments, and implement those choices. That this has not been done is unrelated to economic capability.

We find that few efforts now go to mobilization planning. A planning framework, coordinated with the Graduated Mobilization Response procedure, would provide a mechanism to address this issue. To address it fully would require understanding how to make civilian economic capacity meet defense needs, a task that would include comparing the nation's need for unique materiel with more producible items that could draw from the strengths of the civilian sector.

We find that many firms and organizations now supplying the Department of Defense (DOD) have reason to identify the nation's defense needs with their own needs and seek protection and subsidy to continue operations. Often these requests are couched in terms of the changing international economic arena.

We find offshore sourcing to be a genuine source of potential vulnerability, but suggest that it should be addressed on a case-by-case basis and compared against individual DOD targets. Serious attention should be given to finding ways to secure vulnerable offshore sources, rather than seeking subsidies for domestic industries that may or may not be relevant to next period's weapons requirements. As is true for surge, we believe the mechanisms to overcome this problem are available.

We find that the reasons for revising the current acquisition system--with its multiple goals and emphasis on DOD command and control--are virtually parallel to those that call for U.S. firms to adopt new, innovative attitudes when competing in international markets. A revised acquisition system would seek economic efficiency and cost-effectiveness, while providing contractors with genuine opportunities for performance-based profits and losses.

We find the technology issue to be more simple than many would state it. The nation needs a technology agenda, a part of which would be defined by its defense technology. Civilian spinoffs are a weak case on which to justify defense R&D. In addition to weapon performance, technical R&D should emphasize flexibility, producability, and cost-effectiveness.

Overall, this study suggests that past mobilizations are viewed more positively than the facts justify and that calls to restructure the economy to resist forces of international economic change should fall on deaf ears. The nation has ample reason to seek efficiency, to plan, and to set economic priorities without waving the defense banner, noble as that banner may be. The nation should seek greater security by integrating defense economic policy with national economic policy, seeking positive ways to provide contractors with economic incentives, and embracing the opportunities presented by opening world markets.

I. INTRODUCTION

DEFENSE POLICY AND ECONOMIC CHANGE

The United States pursues a defense policy keyed to technological and economic superiority. Since the Second World War, this policy has embraced two distinct weaponry components--one strategic (or nuclear), and the other conventional. The strategic component has borne responsibility for deterring direct aggression by the Soviet Union and has become the ultimate fall-back position in the event of major U.S.-Soviet conflict. The conventional component has become a vehicle for maintaining world-wide military presence and for dealing with regional conflicts. This defense policy has proved extremely viable over the past forty years. Massive conflicts have been avoided and--subject to U.S. foreign policy goals--regional conflicts have been managed.

Today, however, the continued viability of this defense policy is in question. Three basic changes have weakened its foundations and may call for policy redirection. The first is the changing balance between strategic and conventional forces. It has long been anticipated that the ultimate outcome of the nuclear arms race would be a stalemate with growing incentives for arms reduction. The arms reduction process is now underway, and, while reducing the threat of nuclear holocaust, it places additional reliance on conventional weaponry for deterring U.S.-Soviet war.

The second change is in the world economy. Whereas the U.S. emerged from WW II as the sole economic superpower, economic events, supported by U.S. policy, have led to broad redistribution of economic wealth, essentially through economic growth. The U.S. no longer enjoys

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a natural relative advantage over other nations in technology or economic capacity--the foundations of past defense policy.

The third basic change lies in the nature of the U.S. economy and its ability to produce its conventional weapon systems in a responsive and adequate manner. Domestic industries once thought vital for defense are now in decline, and questions have been raised as to the forward-looking nature of a coordinated defense industrial policy, if indeed such a policy exists.

These changes must be examined against existing defense strategies and institutions. The nation has deployed nuclear and conventional weapons differently. In effect, nuclear weapons are deployed at full strength. Conventional weapons are deployed at partial strength with emphasis on mobilizing production to bring inventories to strength as the need arises. In the latter case, planning for production substitutes for inventories.

The industries that supply defense goods interact with the Department of Defense (DOD) through a complex acquisition system which must supply both current needs and preparedness resources called for by mobilization planning. There is increasing concern that this system, with its multiple goals and reliance on instructing contractors through regulations, rather than guiding them through incentives, has led to unnecessary inefficiencies and inflexibilities. The defense sector sustained by this system appears to be increasingly specialized in DOD production, increasingly isolated from the commercial portions of the U.S. economy, and increasingly tied to offshore producers.

In sum, there is evidence that the U.S. economy may no longer be following a course which leads naturally to a capability to support a massive and rapid buildup of conventional weaponry, but that the need for this capability is growing. If this is true, existing policy is inadequate to meet current and future needs.

PURPOSE

The purpose of this report, and the research underlying it, is: (1) to review the evidence that supports and refutes current defense policy as it relates to the ability to carry out a military buildup, and (2) to outline alternative policy paths that could increase the ability to carry out a buildup. This report is a summary document which highlights policy concerns and alternatives. A companion document and set of working papers contain more detailed analysis.

In carrying out this work, we have avoided questions of budget size and have instead focused on tradeoffs that may offer increased efficiency. We have found no simple nor singular answers, but many policy choices that could advance or retard the ability to support a conventional war. Many studies have addressed various aspects of this issue previously, and our findings embrace a number of their conclusions, but we also differ from most of them in fundamental ways. We feel our contribution lies in an economic perspective, in synthesis, and in objectivity.

MAJOR CONCLUSIONS

Our major conclusion is that world and domestic economic change is inexorable and that policy should seek to accommodate rather than reverse economic change. Current policy is too fragmented and uncoordinated to do this. We also feel that there are many opportunities to increase efficiency by reducing the role of regulation and increasing the role of incentives.

We find that much of the current policy debate over how to guide and prepare for a defense buildup has been improperly focused. We suggest that policies which impact the nation's ability to carryout a defense buildup can potentially impact the economy at three different levels--the national level, the sectoral level, and the firm level--but that policy debates often fail to address them as such. National economic policies should address economy-wide issues while considering defense implications, and defense policies should address defense issues while considering national implications. DOD should typically deal with firms, while the civilian agencies deal with the economy as a whole. At the sectoral level, responsibility should be shared. If the ability to carry out a military buildup is to be supported consistently, policies aimed at each of the three levels must be coordinated.

We find that the current concept of decentralized industrial preparedness planning (IPP), based on what we perceive to be a WW II model, is inadequate for this larger task. An improved policy would be much more tightly integrated with other governmental activities that affect the defense industrial base. It would be dynamic and forward-looking, would embrace economic

realities as readily as it embraces military strategy, and would seek to spend resources to bring economic capabilities in line with expectations.

In particular, we find expectations for a massive, impromptu economic buildup out of line not only with current capabilities, but with past performance. The economic buildup for WW I was short and not very successful. The buildup for WW II was considerably longer and much more successful, but was very costly and conditioned by the economic depression that preceded it. The Korean buildup was strongly supported and quite effective, but came so shortly after WW II that it was able to draw heavily from already available resources. Vietnam, in contrast, can hardly be termed a buildup. We have never accomplished the kind of economic buildup our policy envisages and requires.

We find that modern weapons are so costly and can be expended so rapidly that the focus of IPP has switched from mobilization to surging production of specific weapon systems and end items to support small conflicts. Even with this switch, few resources have been spent to support surge capability, and no system has yet been successfully surged. Little attention is currently paid to mobilization, and few resources are spent to increase the ability to mobilize.

We find that the effects of declines in U.S. economic capacity on the ability to mobilize are overstated. By most measures, the U.S. has a robust and growing economy, but it is a very different economy than during the World Wars I and II mobilizations. We find that economic ties to other nations are desirable and economically stimulating. Without them, the U.S. economy would be less vital. But again, our economic relationships abroad are different than before and

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present new challenges. We find that access to advanced technologies is as important to our defense effort as access to massive industrial capacity. We find the U.S. to be a leader in technology development, but a laggard in technology transfer.

Finally, we would be remiss in not recognizing at the outset the massive efforts and changes already underway and planned in the DOD and the Military Departments to expand the ability of the nation to produce war materiel rapidly. These are hands-on efforts by practitioners, undertaken with much deliberation and concern, and they will make a difference. Yet even with those efforts, there remain additional concerns.

II. BACKGROUND

FEMA SPONSORSHIP

This report and the research on which it rests have been supported by the Federal Emergency Management Agency (FEMA) and conducted by the Oak Ridge National Laboratory's Energy and Economics Analysis Section (ORNL). FEMA is unique among Federal Agencies, because it is specialized in emergency management and serves as a planner and coordinator of activities by the Federal Departments and Agencies during national emergencies. ORNL is a Department of Energy National Laboratory with a broad-based research agenda.

PROJECT SCOPE

In its charge to ORNL, FEMA requested a study that broadly considered the ability of the nation to support a military buildup, how that ability had changed in the light of changing economic conditions, and how new policies, sensitive to economic forces, could improve this ability. ORNL interpreted this mandate as considerably exceeding an examination of what has become known as industrial preparedness planning (IPP). In IPP, the Military Departments and Services conduct analyses that indicate the ability of defense industries to surge production of critical items in peacetime or to produce a broader range of items rapidly in a mobilization. Surging production means to increase production in peacetime by some multiple of business-as-usual production using existing facilities to satisfy increased demands for specific weapons or end items. Properly planned,

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peacetime surge may serve as a precursor to mobilization. The mobilization process involves converting more of the economy to materiel production than is usual in peacetime. Mobilization must thus consider the overall capacity of the economy to produce weapon systems, other end-items, munitions, and other consumables.

In addition to surge or mobilization, there is a third level of preparedness that rests on the general health of what has become known as the defense industrial base. The defense industrial base may be construed as narrowly as to include only plants currently producing war materiel or as broadly as to include the overall character of economic activity that influences the current and future ability of the nation to defend itself. In this report, we examine each--surge, mobilization, and the overall health of the defense industrial base.

Lastly, there are significant differences between policies and procedures intended to prepare for industrial buildups and those intended to implement them. Preparation policies focus on planning, peacetime investments for surge and mobilization, and economic incentives for firms to behave in ways that support these policies and procedures. Implementation policies concern themselves with such matters as assignment of responsibilities, testing of administrative relationships, and actual resource availabilities. This report focuses on preparedness, while realizing that implementation issues are closely related.¹

¹For discussion of mobilization policy implementation issues see, John R. Brinkerhoff, "Arsenal of Democracy in the Face of Change: Issues Underlying the Implementation of Industrial Mobilization Policy, Working Paper No. 3," ORNL/TM-11274; and John R. Brinkerhoff, "An Organizational Structure for National Mobilization: The War Cabinet Approach," Brinkerhoff Associates Draft Working Paper, February 1989.

CURRENT IPP ACTIVITIES

The Federal Government carries out IPP at a variety of different levels with virtually every Agency and Department sharing in the responsibility. As the nation's chief executive officer and military commander-in-chief, the President has fundamental responsibility for mobilization planning. In executing this charge, the President draws upon advice from the National Security Council and relies heavily on DOD for carrying out general policy guidance.

Within DOD, responsibility for IPP is divided between the OSD, the Military Departments, and the Organization of the Joint Chiefs of Staff (OJCS). In simple terms, the OSD sets the protocol by which DOD interacts with its contractors, the military Departments perform IPP and production base analyses (PBAs), and the OJCS provides a warfighting perspective.

The OSD has recently overhauled several mechanisms through which it interacts with the private sector, patterned largely after a major report prepared by Dr. Robert Costello, then Under Secretary of Defense for Acquisition (USD/A), entitled Bolstering Defense Industrial Competitiveness. In his letter of transmittal to the Secretary of Defense, Costello wrote

Our objective was to identify the actions necessary to prepare the Department better to deal with the dynamics of manufacturing worldwide. The recommendations we are already putting into action center around six major thrusts: forging the right relations with industry; improving the acquisition system; establishing defense industrial plans that support our military strategic plans; developing manufacturing capabilities concurrent with the development of weapon systems; laying the foundation now for the technical skill base required for tomorrow's defense needs; and ensuring that the

industrial base issues important to our defense benefit from the full spectrum of potential policy remedies.

The Military Departments, in carrying out IPP and PBAs, identify accelerated production requirements (with OJCS assistance) and attempt to match them with available domestic plant capacity, tools, materials, and manpower. Where shortfalls exist, the Military Departments have the option of funding surge capacity, purchasing additional inventories, or funding the development of technologies that will alleviate the projected production bottlenecks.

The OJCS translates operations plans (war plans) into production requirements. It does this by soliciting input from the theater commanders (CINCs) and combining these inputs into an annually updated critical items list (CINCs CIL). It also conducts exercises that simulate military operations by the CINCs to generate estimates of requirements under alternative warfighting scenarios.

The civilian Agencies and Departments are assigned IPP responsibilities that follow from their peacetime specialties. Of particular note is FEMA, whose peacetime mission is emergency planning and whose wartime mission includes the overall coordination of civilian national security emergency preparedness planning. The Department of Commerce (DOC) carries out studies of the defense industrial base in peacetime and administers the Defense Priorities and Allocation System for industrial production in peacetime and wartime. The Department of Transportation plans for emergency augmentation of DOD transportation capability and manages national transportation resources in wartime. The Department of Energy manages the Strategic Petroleum

Reserve and oversees the production of nuclear weapons. Other Departments and Agencies also have important, but smaller, roles.

RECENT IPP INITIATIVES

A number of recent changes in the IPP process have altered its character significantly. One is renewed emphasis on investment spending to overcome projected surge bottlenecks. DOD can write contracts with surge option clauses, though few surge options have been written. One major weapon system to have funded surge capability is the TOW 2 missile, whose contract initially contained a clause to ensure that production could be doubled within six to twelve months. DOD has also tried to institute inventory control programs (rolling inventories) whereby key parts required for future deliveries are preordered to avoid production bottlenecks in time of surge. However, there has been little other investment in the ability to produce war materiel rapidly.

A second recent change is the combination of Canadian economic capacity with U.S. economic capacity for the purpose of IPP. The combination is referred to as the North American Defense Industrial Base (NADIB). Because of the long-term special relationship and geographical proximity enjoyed by Canada and the United States, it has been possible and acceptable to work together closely to prepare combined industrial plans.

A third recent change is the reaffirmation of Federal Department and Agency responsibilities through the issuance of Executive Order 12656 on November 18, 1988. This Order assigns responsibilities for national emergency preparedness planning across the government.

A fourth recent change is the adoption of Graduated Mobilization Response (GMR) as national policy. GMR is a planning system which helps to clarify actions and roles to be taken by the various agencies of government as a wartime emergency develops. The concept is being implemented as a three stage system, similar to the DOD Defense Conditions (DEFCONs). Stage three focuses on planning and preparedness. Stage two is the crisis management stage, within which the initial, incremental steps of mobilization are taken to increase the production of critical items and systems. Stage one is the national emergency phase in which additional incremental steps are taken to achieve full and then total mobilization.

A major advantage of GMR is that individual, often ad hoc, decisions and actions are replaced by preplanned response options. There is a logical progression from peace to war. Early in stage two, production might take place under peacetime constraints (e.g., inspection, contracting, safety, and environmental regulations), but later in stage two, some or all of these constraints would be relaxed. This steady progression indicates to adversaries the seriousness with which the crisis is viewed and increases production rapidly by reducing decision lags.

A fifth recent change has been the development by the OJCS of the Joint Industrial Mobilization Planning Process (JIMPP). JIMPP is intended to link operations plans for various contingencies to the production capacity of current defense producers in a computerized micro

module and to the larger economy through a macro module. The OJCS combines establishes demands for a list of critical items nominated by the theater commanders and attempts to match this demand against aggregate existing production capabilities. This is important, because the individual Military Departments may neglect requirements by other Departments or may double-count production capacity in their PBAs.

Determining production capacity is a difficult task. Typically, a prime contractor is awarded a production contract through which it acts as a project manager and final assembler, subcontracting for specialized components or parts. The subcontractors repeat this process until a multi-tiered production network is developed. The lower tiers may contain highly specialized producers who produce a narrow product line for several prime contractors for different Military Departments. The lower tiers often contain offshore sources. This process is fairly well understood in concept, but its application requires a detailed data base that does not now exist. At present, JIMPP is as a well accepted planning concept and a partially computerized modelling system, but it is not a fully operational and integrated system.²

In addition to JIMPP, the OSD has developed a contractor/subcontractor accounting network termed the Defense Industrial Network (DINET). DINET collects manufacturing data that permit identifying sole source, single source, and offshore suppliers through subcontractor tiers. Unfortunately, it does not appear that DINET will supply all of the data needed to

²We have examined JIMPP data requirements in some detail in David A. Trumble, "Arsenal of Democracy in the Face of Change: Computer Programs for Micro Analysis of Surge and Mobilization Capability: Review and Recommendations," Working Paper No. 7," ORNL/TM-11279.

complete JIMPP, despite a projected data collection budget that if funded will cost \$29 million over the next five years.

The sixth and final set of changes that have taken place deal less with IPP than with the overall ability of OSD to deal with its contractors, as described by Costello above. These changes are treated in the following review of critiques of the current system.

CRITIQUES OF THE CURRENT SYSTEM

Over the past several years, the ability of the defense industrial base to support surge or mobilization demands has received an increasing amount of attention. Table 1 presents a list of ten major studies of the defense industrial base completed during the past two years which were among the many studies reviewed for the writing of this report. These studies are generally representative of the types of analysis, conclusions, and recommendations that have been forthcoming. The diversity of the groups sponsoring or conducting the studies is noteworthy, and each group represents a particular set of interests and a particular viewpoint. Studies were conducted for OSD and the Military Departments, for FEMA, lobbying groups, and for Congress. In selecting these particular studies, an attempt was made to provide a diversity of views, rather than to support a specific policy position.³

³A more detailed discussion of the specific recommendations contained in each study may be found in, David J. Bjornstad and Barbara H. Hardy, "Arsenal of Democracy in the Face of Change: Issues and Policy Options in Industrial Preparedness Planning, Working Paper No. 2," ORNL/TM-11273.

Table 1. Selected recent studies of the defense industrial base

1. Office of the Secretary of Defense, Undersecretary for Acquisition, Bolstering Defense Industrial Competitiveness, July 1988.
 2. Office of Technology Assessment, The Defense Technology Base, March 1988.
 3. The Air Force Association, Lifeline in Danger, Aerospace Education Foundation, September 1988.
 4. American Defense Preparedness Association, The Ammunition Industrial Base, January 1988.
 5. Center for Naval Analysis, Options for Improving Naval Industrial Preparedness Planning, August 1988.
 6. Libicki, Martin C., Industrial Strength Defense, Mobilization Concepts Development Center, National Defense University, 1988.
 7. The Analytic Sciences Corporation, "Affordable Strategies to Ensure Industrial Responsiveness," Federal Emergency Management Agency, March 1987.
 8. Manufacturing Studies Board, Manufacturing Technology, National Academy of Science, 1987.
 9. Manufacturing Studies Board, The Semiconductor Industry and the National Laboratories, National Academy of Science, 1987.
 10. Ellison, John N., and Timothy W. Stanley, "America's National Security and the Vanishing Mobilization Option," International Economic Studies Institute, October 1987.
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However, once the overlap among these ten studies is removed, the recommendations can be summarized in seven categories. This is done in Table 2. Many of the recommendations have already been put into place, and these are denoted in Table 2 with an asterisk.

The first category of recommendations concerns planning and information exchange mechanisms. DOD has already adopted and begun to implement several of its own suggestions, though they have been in place too short a time to evaluate. For example, GMR implementation is complex, will require cooperation from a number of groups, and is dependent on gathering appropriate data.

Impetus to create a national agenda for surge and mobilization has come largely from outside DOD, partly in response to DOD's fragmented approach to IPP and partly over concerns that important parts of the defense industrial base are in decline. Studies by the National Academy of Science have addressed the issue of a declining defense industrial base from a national perspective, with such suggestions as involving Department of Energy laboratories in certain aspects of R&D. Other studies by advocacy groups have called for governmental protection and/or subsidy for domestic producers. A framework that permits comparing such diverse suggestions is required.

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Table 2. Summary of recommendations

1. Planning and Information Exchange
 - a. Create a national agenda for surge and mobilization strategy
 - Review role of surge/mobilization on defense strategy
 - Review assignment of policy/action roles among agencies and within DoD
 - b. Create new DOD institutions
 - Advisory bodies*
 - Production base advocate*
 - c. Create internal DOD mechanisms to coordinate policy and action
 - GMR*/JIMPP*/DINET*
2. Surge Planning
 - a. Establish link between war plans and production capacity
 - b. Estimate additional capacity needs under policy assumptions
 - c. Provide surge capacity/inventories through existing contracts
3. Mobilization Planning
 - a. Establish voluntary and standby agreements
4. National Industrial Policy
 - a. Labor training in schools and on-the-job
 - b. Conduct impact analyses of tax policies to support defense industrial base
 - c. Conduct impact analyses of trade policies on defense industrial base
 - d. Conduct impact analyses of other civilian policies and activities industrial base
5. Dependence on Offshore Sources
 - a. Provide information to identify offshore dependencies, focusing on tiers*
 - b. Consider how to reduce or offset vulnerability
 - Prohibit or limit offshore purchases
 - Stockpile offshore components
 - Subsidize domestic producers
6. Improvements to Acquisition System
 - a. Increase stability of multi-year funding
 - b. Reduce use of MILSPECs, increase use of commercial components*
 - c. Use life cycle costing*
 - d. Ensure quality control*
 - e. Provide better incentives to producers
 - To modernize/invest; to cut costs; to conduct R&D
7. Technology Policy
 - a. Incentives for contractors to innovate
 - b. Evaluate and support defense sector specific technology as through MANTECH
 - c. Evaluate and support generic technology base, as it may support defense

*Adopted by DOD

We suggest in addition that greater efforts should be taken to incorporate supply side information in demand side decisions. In simple terms this would mean comparing weapon effectiveness with weapon cost and choosing weapon groups that offer relative economies for equal performance. Such an approach is necessary to counter current cost trends which extrapolate to single weapon systems devouring the entire DOD budget in the foreseeable future. It also introduces weapon costs relative to performance as a consideration in warplanning. With GMR and increasingly sophisticated wargame exercises, more attention than before is being paid the impact of supply considerations on operations policy.⁴

The second category groups a number of surge-related recommendations. The first recommends linking warplans to productive capacity. This task is difficult but could be done if tied to an operational data base such as a completed JIMPP. Most authors believe that IPP should focus on removing bottlenecks from surge capacity, partly because that is the easiest thing to do. The primary missing ingredient in surge planning is willingness to commit resources. JIMPP would provide an effective vehicle for surge planning, if equipped with a proper data base.⁵ Even with needed information, however, planning will not substitute for committing resources where surge investments are required. No one knows exactly what the costs of providing surge capability for

⁴See John R. Brinkerhoff, "Global War Game 88: Some Lessons Learned," FEMA, December 1988, for a further discussion of growing recognition in exercises of the importance of supply constraints.

⁵See Trumble, *op. cit.*

the CINCs CIL would be, but Libicki has estimated that surge investments of \$550 million could lead to an ability to triple production of ten selected precision guided munitions, over a fifteen month period. If these numbers are at all accurate, providing an ability to surge is less difficult than many argue.⁶

The third category of recommendations has to do with mobilization planning. Very little has explicitly been stated in these studies about mobilization, though implicitly many of the concerns raised about the overall performance of the national economy relate to the ability to mobilize. Many studies discuss pre-arrangements, such as the voluntary agreements which were in place but not used during the Vietnam buildup.

The fourth category of recommendations deals with national industrial policy to enhance the defense industrial base. To some extent, analyses of policy impacts on the defense industrial base are now being carried out, but there is no systematic, integrated effort underway. More importantly, it is well understood that the numerous laws, rules, and regulations promulgated by the Federal Government have a decided effect on the ability of the economy to meet mobilization goals, but a systematic review of these effects has never been undertaken.

The fifth category of recommendations deals with dependence on offshore sources. This dependence is a sensitive issue, both because it can cause vulnerabilities and because to some it

⁶Libicki bases his calculations on the so-called PGM data base, a compilation of information from studies by the OJCS, the Center for Naval Analysis, the National Defense University, and numerous contractor reports previously used as input to PBAs. His results are controversial, but they form a point of departure for additional work on which to judge surge investment spending.

represents a potential policy response to what has been characterized as an erosion of the industrial base. Three sorts of vulnerability have been identified. One concerns the ability to maintain supply lines, the second concerns the ability to achieve cooperation in times of crisis and war, and the third deals with potential loss in technological leadership that can result from allowing offshore firms to access/develop defense technologies. All studies reviewed stopped short of recommending the fairly obvious option of counting offshore production as part of our industrial base and taking steps to secure it, by addressing the relevant source of vulnerability. We believe this is a viable option.

The sixth category of recommendations has to do with improving the DOD acquisition system. Several of the suggestions to improve the acquisition system have recently been adopted, but most have continued the tradition of DOD providing strict instructions to contractors regarding not only outputs but virtually all aspects of the production process. They have also been implicitly based on the concept implicitly advanced in the Packard Report that dealing with the Government is as much a patriotic activity as an economic one (p. 7). Many difficulties now experienced in the acquisition process could likely be alleviated by allowing firms' profits and losses to be directly based on performance.

The major impact of the procurement system on the ability to mobilize is that it virtually determines the structure of the contracting industry. To the extent that very specialized management and administrative skills are required to do business with DOD, firms will tend to specialize in these skills, and non-specializing firms will be precluded from direct interaction with

DOD, though their products or services are often purchased by prime contractors through subcontracts.

The seventh recommendation concerns technology. Technology policy permeates nearly all aspects of surge and mobilization planning. Providing incentives for contractors to invest and conduct R&D, while part of acquisition, also concerns how new technologies become imbedded in the capital stock. Sector-specific technologies, as supported through the Semiconductor Technology Research Institute (SEMATECH) and the Manufacturing Technology Program (MANTECH), provide generic capability to produce existing or planned weapons systems. The Industrial Modernization Incentives Program (IMIP) is typically grouped with IPP activities but, actually, is closely related to the constraints imposed by DOD procurement policies which preclude contractors from making needed investments without DOD approval. The Office of Technology Assessment has argued that generic technology support is almost impossible to separate into military and civilian components. If this is true, it weakens the argument that DOD should directly oversee general technology development programs.

SUMMARY

In simple terms, the literature analyzing IPP can be summarized into three types of considerations. The first is the policy planning process. It concerns what surge and mobilization needs are, what resources will be made available to meet these needs, and what general mechanisms should be established by the Federal government to make these determinations. How one structures

this process determines the types of policies that will be developed. For example, to bring resource availability and cost information into the DOD warplanning process means breaking with a long-standing tradition of objectives planning in which the focus is on what is desired rather on what can actually be done.

The second type of consideration concerns the level of activity at which policy is targeted. Three levels are implicit from Table 2. The first level is the firm on which surge policies are focused. It is through these relationships that DOD arranges for current purchases and makes investments to fund surge capacity. Procurement policies influence the character of the industrial base at this level.

The second level is the economic sector on which policies to support a mobilization are focused. Sectors provide the markets in which firms under contract with DOD draw resources--the specific technology, labor pool, and materials, acquired either directly or through tiering by prime contractors. During a mobilization they provide the redundancy not under direct surge contract that permits expansion of war materiel through conversion of existing capacity.

The third level is the overall national economy on which national industrial policies are focused. This is the economic environment for the sectors--the overall technology base, labor markets, product markets, access to international markets, and governmental policies--which shapes the ability of the United States to defend itself.

The third consideration which the Government faces in executing surge and mobilization policies has three issues -- (1) what rules should it establish to deal with the private sector? (2) how

should it deal with vulnerabilities due to offshore sources? and (3) how and to what degree should it invest directly in productive inputs and technology? Each of these issues has implications for firms, sectors, and the economy as a whole, but each requires a different policy response. These are summarized in Table 3 in terms of the option to pursue current policy or an alternative policy.

At the firm level the current approach to foreign source vulnerability is to invest in surge capacity domestically. The primary alternative is to secure foreign sources taking into account specific types of vulnerability. Current policy to enhance technology at the firm level operates through the IMIP and related programs. Alternative firm-targeted policies would reduce uncertainties and permit firms to recoup investments as is done in the private sector. The current approach to improving relations between DOD and its contractors is firmly wedded to traditional relationships in which DOD provides explicit directions to contractors. Alternative policies would rely more on positive incentives and contractor discretion and less on DOD guidance.

Sector based policies dealing with foreign trade focus on protection justified by DOC analysis. Alternative policies would be explicitly targeted at sectors within the larger context of a general national policy. Current sector-targeted technology programs are managed by DOD through such activities as MANTECH and SEMATECH. Alternative policies would be sector targeted within the context of a national policy and would draw more heavily on civilian Agencies and Departments.

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Table 3. Summary of policy choices to mobilization capability

	National Current Alternative		Sector Current Alternative		Firm Current Alternative	
Domestic Foreign Production	No explicit policy	Establish general explicit policy	Protection by Sector	Establish targeted explicit policy	Domestic investment/subsidy	Secure foreign sources
Technology/ Factor Enhancement			MANTECH SEMATECH DOD programs	Sector targeted Federal programs	IMIP	Incentive based
Public/ Private Sector Interactions					Central based	Incentive based

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There is currently no explicit national approach to foreign competition, nor, for that matter, for interactions in matters of technology between the public and private sectors. An alternative would be to document the impacts of current implicit policy.

III. PAST MOBILIZATIONS

THE BACKGROUND OF INDUSTRIAL MOBILIZATION

The United States has gone to war four times in the 20th Century--WW I, WW II, the Korean War, and the Vietnam War. Each of these wars was different in degree and kind, and each required a different measure of industrial mobilization.

WW I is arguably the first war in which modern industrial capacity had a significant impact on the outcome, if only because the emphasis was evolving from men and horses to men and machines. Despite the relatively late entry of the U.S. into the conflict (hostilities began in 1914 and the U.S. entered in April 1917), the ability of the U.S. economy to supply its own troops was extremely limited until nearly a year later (Kennedy, p. 270). During the first year of its participation, the U.S. spent roughly \$4 billion (in current dollars) to purchase 50,000 pieces of artillery and ammunition, but only 143 pieces were actually delivered. Over 23,000 tanks were ordered, yet none was available even for domestic training (Vawter, p. 7). Only 107 of 1,741 ships that were ordered were actually completed by the war's end (Gill, p. 4). Most U.S. fighting was done with weapons provided by our allies.

If in WW I the capacity to produce modern weaponry grew in importance, in WW II this capacity proved decisive. For practical purposes, WW II dates from 1939, and the U.S. entry into the war, from December 1941. Although, the U.S. entry was delayed, preparations were already begun, largely because the U.S. had been supplying its allies through Lend-Lease. Once the U.S.

economy was totally committed to the war effort, the results were remarkable. During the war years, about 1,600 new plants were built (Vawter p. 7). Ship building accomplishments were striking. At peak, the U.S. produced a Liberty ship in 50 days, and in all, 5,200 warships were built over the period (Gill, p. 6). Airplane production was no less impressive, increasing from around 6,000 in 1939 to about 100,000 in 1944, nearly twice the output of the entire Axis economy (Kennedy, p. 354).

Korea marked the first deliberate usage of industrial capacity as an element of strategy. Although this war dated from June 25, 1950 when North Korea invaded South Korea, the larger character of the time was expressed in NSC-68 A Report to the National Security Council. This report asserted that the Soviet Union had achieved rough parity with the U.S. in nuclear weapons technology and had set an industrial path that, if continued, would lead to parity in conventional weaponry. It further stated that the goal of the Soviet buildup was international expansion and recommended a policy of containment to counter this.

Using a capacity for mobilization as an element of deterrence was an abrupt change from past mobilization activities. Due to the success of R&D conducted during WW II, technological development also became an element of defense planning. It was only a short step for mobilization planning to encompass technological as well as industrial capacity, and President Truman responded accordingly by requesting resources and authority beyond those called for by the military situation in Korea.

In contrast, during Vietnam, the nation's agenda was more acutely divided, and the Johnson Administration sought to pursue the war as an extension of routine defense activities. This led to abandoning such mobilization planning efforts as the "planned producer program" (Gill, p. 16), a set of formalized voluntary relationships between industry and Government, whereby individual firms agreed to meet rapid production schedules under certain circumstances. By using competitive procurement to obtain its war materiel, the Government sent a confusing message to firms that had participated in the Government-sponsored IPP program.

DEFENSE EXPENDITURES AS A PERCENTAGE OF GNP

Table 4 shows the percentage of GNP devoted to defense during the four mobilizations⁷. The WW II mobilization was the largest in terms of both the maximum and average percentage of GNP devoted to defense. The growth was 8.3 percent annually, from 1.4 percent in 1939 to a high of 42.8 percent in 1944. WW I brought the country to its second highest level of defense spending, 17.4 percent in 1918. The growth also was sharp, 8.2 percentage points annually. The average level was only 10.4 percent over the war years including 1919, because of the relatively brief military involvement.

⁷The following section is based on George Horwich, "Arsenal of Democracy in the Face of Change: Four U.S. Mobilizations: A Macroeconomic Perspective, Working Paper No. 5," ORNL/TM-11276.

Both the Korean and Vietnam mobilizations built upon relatively high levels of pre-war defense spending. After WW II, defense spending did not fall below 5 percent of the GNP, well above the pre-mobilization levels for both World Wars.

Table 4. Defense spending as a percentage of GNP in mobilizations

	WW I	WW II	Korea	Vietnam
Pre-Mob	1.1 (1916)	1.4 (1939)	5.1 (1950)	8.0 (1965)
Maximum	17.4 (1918)	42.8 (1944)	13.5 (1953)	9.8 (1967)
Average ^a	10.7 (1917-19)	37.7 (1942-45)	12.3 (1951-53)	9.2 (1966-69)
Increment ^b	9.6	36.3	7.2	1.2

^a For years of relatively high mobilization
^b From pre-mobilization to wartime average

A basic indicator of the economic impact of a mobilization is the difference between pre-war defense spending and the average of defense spending sustained over the war years. As a percent of GNP, this difference is 36.3 percent for WW II which emerges as the only really substantial mobilization. It is 9.6 percent for WW I, 7.2 percent for Korea, and only 1.2 percent for Vietnam.

INCREMENTS IN GNP AND DEFENSE SPENDING

A measure of the degree to which a mobilization burdens the economy is the extent to which growth in defense spending is met by growth in GNP. Table 5 shows the increments of real GNP and real defense spending for each of the four mobilizations.

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Table 5. Increments in GNP and defense spending (DEF)
(billions of constant \$)

Year	WW I (1929 prices)		WW II (1947 prices)		Korea (1954 prices)		Vietnam (1972 prices)	
	GNP	DEF	GNP	DEF	GNP	DEF	GNP	DEF
1	(1917) -1.6	2.6	(1940) 14.1	1.9	(1951) 23.7	18.2	(1966) 55.5	12.3
2	6.1	9.3	26.6	16.3	11.7	12.3	26.6	12.3
3			25.4	46.9	15.5	3.1	46.7	2.1
4			25.3	34.9				
5			19.3	12.7				

These data indicate that the burden of mobilization on the civilian economy has lessened for each successive mobilization. During WW I, there was insufficient growth in the economy to meet the mobilization requirement. GNP actually declined in 1917. In both 1917 and 1918, increases in defense spending were accomplished at the expense of civil sector spending, although the differences were small.

Both Korea and Vietnam were fully accommodated by increases in total output. On average, Korea absorbed about 66 percent of each year's growth increment. Vietnam took only about 21 percent of each year's GNP growth on average, and GNP growth was larger than the growth of defense spending in each year of the war.

Only in two years during WW II did the growth of the economy fall significantly below the wartime requirement. However, the expansion of total output over the entire period was about equal to the huge increments in defense spending. In 1940, 1941, and 1944 (years 1, 2, and 5) the

increases in GNP were much greater than the increases in defense spending. The opposite was true in 1942 and 1943 (years 3 and 4), and in these years defense spending forced reductions in aggregate civilian outlays. Overall, the GNP increased from 1939 to 1944 at an average annual rate of 11.2 percent, which was sufficient to accommodate the defense expenditures.

PERSONAL CONSUMPTION AND DOMESTIC INVESTMENT

The burden placed by a mobilization on the civil sector may also be described by the behavior of personal consumption expenditures and gross private domestic investment. Table 6 shows personal consumption for the mobilization periods of the four wars.

Table 6. Personal consumption for mobilizations
(billions of constant \$)

Year	WW I		WW II		Korea		Vietnam	
	(1929 prices)	%GNP	(1947 prices)	%GNP	(1954 prices)	%GNP	(1972 prices)	%GNP
1	(1916) 49.4	71	(1939) 116.3	74	(1949) 204.3	70	(1965) 557.5	60
2	48.3	72	122.5	71	216.8	68	585.7	59
3	48.1	66	130.9	66	218.5	64	602.7	60
4	50.2	68	128.1	57	224.2	63	634.4	60
5			131.4	53	235.1	64	657.9	60
6			135.0	51				
7			145.2	55				

Only in WW I do total real personal consumption expenditures drop during the greater part of the mobilization period both in absolute terms and relative to GNP. Consumption fell by \$1.1 billion in 1917 and \$0.2 billion in 1918 (years 2 and 3). Throughout the much longer mobilization

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for WW II, personal consumption rose every year but 1942 (year 4), even while declining as a percentage of GNP. For both the Korean and Vietnam Wars, personal consumption in constant dollars rose in every year. The burden of mobilization on civilian spending was not heavy for any of these wars.

Because the fruits of investment lie in the future, spending on investment can and does yield to the demands of mobilization without important negative consequences for either short-term economic welfare or the war effort. Investment tends to be reduced by the uncertain state of both the war and postwar economies and by the crowding out of private investment by Government materiel acquisitions and wartime borrowing. This is shown in Table 7, which presents real gross private domestic investment for each of the four mobilization periods.

Table 7. Private domestic investment for four mobilizations
(billions of constant \$)

Year	WW I		WW II		Korea		Vietnam		
	1916	(1929 prices) %GNP	1939	(1947 prices) %GNP	1949	(1954 prices) %GNP	1965	(1972 prices) %GNP	
1		9.0	13	16.8	11	38.5	13	151.9	18
2		7.9	12	22.8	13	55.9	18	163.0	17
3		6.2	8	28.9	15	57.7	17	154.9	15
4		7.9	11	14.7	7	50.4	14	161.6	15
5				7.4	3	50.6	14	171.4	16
6				9.2	3				
7				13.0	5				

Private domestic investment was curtailed significantly for every war except Vietnam, during which investment dropped only in one year for reasons that may have been unrelated to the war. In WW I, from 1917 to 1918, investment declined from 12 percent to 8 percent of GNP. During

WW II, investment in 1943 and 1944 (years 5 and 6) dropped to 3 percent of GNP, a fifth of its trend level. Investment during the Korean war, as a percentage of GNP, was down relative to its prewar and postwar levels, but not markedly below its longer term trend of fifteen percent. During the Vietnam War, investment again fell somewhat relative to high prewar levels, but not necessarily for reasons related to the war.

CHANGES IN MANPOWER

Another important descriptor of a mobilization is the level of employment and the diversion of workers from the labor force to military service. The increases in civilian employment shown

Table 8. Manpower changes during four mobilizations

	WW I (1917-18)	WW II (1941-44)	Korea (1951-53)	Vietnam (1966-69)
<u>Increases (000s)</u>				
Civilian Employment(% change)	526 (1.4)	6,440 (13.6)	2,261 (3.8)	6,814 (9.6)
Military Service	<u>2,723</u>	<u>10,870</u>	<u>1,895</u>	<u>783</u>
Total (% change)	3,249 (8.5)	17,310 (36.0)	4,156 (6.9)	7,597 (10.3)

in Table 8 are the total increases in that category occurring during the mobilization periods, not merely those increases associated with the war effort.

Premobilization military strength was low before both World Wars. In 1917 and 1918, almost 3 million men were added to the military, while civilian employment increased 526,000,

although only by 1.4 percent. During the years 1941-1944 inclusive, when military strength was increasing by almost 11 million people, civilian employment increased by 6.4 million or 13.6 percent, and total employment, including the military, increased by 36 percent.

For both Korea and Vietnam, military strength was high at the outset of mobilization. For Korea, 1.9 million military personnel were added to the existing active duty force of 1.7 million. For Vietnam, the comparatively small number of 783,000 military personnel were added to the prewar strength of 2.7 million.

The pertinent question is: where did the additional people come from for these additions to the work force? There are three general sources: unemployed persons, additional persons entering the work force, and additional persons in the working age population. Table 9 presents estimates of the sources for each of the four mobilizations.

In all of the wars except Vietnam, a reduction in premobilization unemployment was a major source of additional manpower. That source was not important for the Vietnam mobilization and is not likely to be a major source of additional workers in future mobilizations.

Increased labor force participation was most important for WW II, but it was also significant for WW I and Vietnam. In WW II, the additional workers were largely women who transferred from household to market employment. Future mobilizations cannot rely on bringing many more adults into the work force because of already high participation rates both by women and young people. For both Korea and Vietnam, over half of the additional manpower required was supplied out of population growth. This source could remain important in a future protracted war.

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Table 9. Sources of manpower increases in four mobilizations

Increases (millions) from	WW I		War II		Korea		Vietnam	
	#	%	#	%	#	%	#	%
Unemployed Persons	1.5	46	7.4	43	1.5	35	0.5	7
Additional Workers	0.9	26	7.5	43	0.4	10	2.4	32
Population Growth	<u>0.9</u>	<u>28</u>	<u>2.3</u>	<u>13</u>	<u>2.3</u>	<u>55</u>	<u>4.7</u>	<u>61</u>
Total	3.2	100	17.3	100	4.2	100	7.6	100

^aColumns may not add to totals due to rounding

SUMMARY

The four economic buildups examined have been very different in startup, duration, scope, and impact on the economy. The WW I mobilization, despite a significant peak resource commitment of over 17 percent of GNP, did not meet materiel needs. The WW II buildup was impressively productive, albeit at a cost of about 43 percent of GNP and under exceptional preconditions. The Korean buildup came closely on the heels of WW II, was effective, and marked the initial use of IPP as an element of deterrence. Vietnam came at a time when eight percent of GNP was already committed to defense; the military buildup was hardly noticeable.

There is little evidence that these mobilizations were supported by substantial reductions in civilian consumption, though there is evidence that some private investment was displaced.

While the aggregate data we examine undoubtedly mask many compositional changes in civilian consumption, no massive decreases in consumption occurred. This indicates that both concerns about civilian austerity and special programs to protect "essential civilian production" are less justified than commonly thought.

Because past buildups have been made possible by economic growth rather than conversion, they have occurred more slowly than many have asserted. To suggest that a major buildup can no longer take place on a rapid time schedule is to belie the fact that none ever has.

Heavy interaction between the U.S. and its allies is very evident in the history of past buildups. In WW I the U.S. was supplied by allies, and in WW II our supply to allies permitted U.S. troops to enter the conflict with the strong ready support of the economy. The fact that the Arsenal of Democracy was located on U.S. shores in WW II is in part a matter of timing and circumstances and sets poor precedence for assuming it should always be so.

Finally, the changes in the structure of the labor force that permitted the massive WW II buildup were unique and resulted both from the severely depressed condition of the economy and the low level of female labor force participation prior to the war. These factors will likely never again exist in exactly this combination.

This review suggests that mobilization policy must be based on a set of explicit assumptions concerning the scope, preconditions, and expected duration. Scope involves expectations concerning the types of conflict the U.S. will engage in and the expenditure rate of conventional weapons. Preconditions include warning time, existing weapons inventories, surge capability, and the role of

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allies. With assumptions about these and accurate appraisals of the capability of the domestic economy, the role of imported industrial capacity, and the state of the technology base, explicit policy options may be formulated.

IV. CHANGES IMPACTING MOBILIZATION POTENTIAL

Having completed an examination of past military buildups, we turn to an examination of the changes that may affect future buildups. There are four types of change that affect the ability of the economy to mobilize: policy changes; changes in weapons characteristics; economic changes, including DOD interaction with the national and world economies; and changes in the acquisition system. The first two changes affect the demands that could potentially be placed by a buildup. The second two changes affect the ability of industry to meet the demands.

POLICY CHANGES

President Reagan's last National Security Strategy (January 1988) emphasized the transitional nature of current defense policy (p. 8). Highlighted are the potentially important contributions our allies' economic growth can make to international security, the emergence of East Asia's economic growth as a potential new factor, and the massive Soviet defense buildup. Since the publication of that report, changes in U.S./Soviet relationships due in part to **Perestroika** and **Glasnost** have continued, with the result that there is increased likelihood for further nuclear arms limitations and reductions in conventional force deployment. These tend to increase the importance of being able to mobilize from a lower active base.

Two other factors that will change the scope of defense policy were also highlighted. The first is the emerging role of technology in conventional weaponry. Improvements in weapon

targeting accuracy for precision guided munitions (PGMs), minimally observable platforms via stealth, and electronic measures for command, control, communications, and intelligence (C³I) are changing the nature of modern military operations. Second is the potential impact of space operations on both nuclear and conventional warfare. Together, these factors imply that innovative, very complicated, and costly systems will dictate new integrated national defense-economic strategy and, consequently, a new role for the national economy to support the defense effort.

Identifying changes in the linkage between economic and military power is, therefore, key in setting new defense policy. During the first half of the century, industrial capacity provided a close approximation to military might. Historian Paul Kennedy has suggested,

Economic prosperity does not **always and immediately** translate into military effectiveness...[but]...the fact remains that all of the major shifts in the world's **military-power** balance have followed alterations in the **productive** balances; and further...victory has always gone to the side with the greatest material resources (p. 439 emphasis in original).

WW I indicated the potential of the U.S. economy in building military might, and WW II demonstrated it. Following WW II, the role of science and technology began to dominate the influence of simple economic capacity, a shift that may qualify Kennedy's simple conclusion.

The essence of the role technological change plays in national security is illustrated by the Soviet-American nuclear arms race. This race combines a technological imperative for warhead effectiveness and delivery system accuracy with a willingness to commit vast economic resources to deploy these technological advances in a rapidly evolving inventory. Two facts distinguished the nuclear age from previous war eras. First, the stated aim of the nuclear arms race is to achieve

deterrence rather than victory. Neither side believes it can emerge from a nuclear exchange as a clear-cut winner. Second, inventories of nuclear weapons are always at full strength. The conventional wisdom is that mobilization can have little impact on a conflict that could arise in a matter of months, or even hours. There is little debate as to development versus deployment.

This contrasts significantly with conventional weaponry strategies. What has emerged is a system in which expenditure on nuclear weapons development and nuclear weapons deployment are accorded equal priority, but expenditure on conventional weapons development has dominated expenditure on conventional weapons inventories. For conventional weaponry, we have thus returned to the pre-WW II model in which planning for production is considered a substitute for actual production capability, and actions taken today are intended to lay a foundation upon which the massive increases in resources that are assumed to become available during a crisis could be rapidly translated into production.

To the extent that the U.S. and Soviet Union are approaching parity in the nuclear arms race, both sides have an increasing incentive to reduce reliance on nuclear weapons, thereby increasing the importance of conventional weapons. This, concomitantly, increases the importance of supplying conventional weapons and places greater weight on the ability to mobilize. President Reagan recognized this in stating that

as nuclear weapons reductions are negotiated, the capability of the U.S. and allied mobilization bases rapidly to generate additional conventional military forces and the supplies and equipment to sustain them, becomes increasingly important. Maintenance of this capability supports deterrence and provides the ability for a

timely and flexible response to the full range of plausible threats (National Security Strategy, p. 21).

In the past, the "full range of plausible threats" has meant preparation for two global scenarios described by the Commission on Integrated Long-Term Strategy as "a massive Warsaw Pact attack on Central Europe and an all-out Soviet nuclear attack" (Discriminate Deterrence). To defend against an invasion in Europe, the NATO Alliance has adopted a defensive strategy termed "Follow-on Forces Attack", which combines the tactical advantage of a defender and the technical superiority of NATO weaponry to counter the massive numerical superiority of Warsaw Pact forces and weapons⁸. While the merits of each side's approach to conventional war are arguable, supplying the fighting forces would require massive injections of materiel by both sides to sustain protracted combat. If the U.S. cannot sustain conventional combat, the threat of escalation to nuclear warfare increases.

The Commission on Integrated Long-Term Strategy argues further that neither of these conflicts is likely. Because of the emergence of the Pacific Basin, Third World economic growth, arms control agreements, and Soviet "restructuring," the Commission calls for an extension to our global war planning scenarios to take into account the more likely, limited scope engagements through a policy of "discriminate deterrence" that permits successful intervention without

⁸Warsaw Pact nations reportedly enjoy only a 3:2 advantage in personnel, but a 5:1 advantage in fighting vehicles, a 3:1 advantage in tanks, a 2:1 advantage in anti-tank weapons, and so on. In no broad category do Alliance forces enjoy numerical superiority. J.H. Milam and D.A. Ruiz Palmer, "Conventional Forces in Europe' What's in the Graphs?" Armed Forces Journal January 1989, pp. 47-52.

necessitating escalation. Such a policy is grounded on continued technical superiority in conventional weaponry and an ability to deploy and supply forces rapidly.

Limited military operations could take several forms. Direct intervention in a regional conflict, such as Vietnam, required a much smaller commitment of economic activity than did, for example, Korea or the world wars. Other activities could include limited incursions or supplying weapons to client states. In these cases, the parameters of the conflict will be much different than those of the major conflicts. The scope will be smaller, warnings may be shorter, timeframes may be limited, and U.S. troops may not be involved directly. Nevertheless, changes in conventional weapons technology may impose new, different constraints than those encountered during the first half of the century. To consider these issues we briefly examine the characteristics of a few selected modern weapon systems.

WEAPONRY CHANGES

Changes in the character of conventional weapon systems and end items during the past forty years have placed new demands on technology and resource commitments.⁹ Performance characteristics improve quickly at substantial expense, and are countered by advances by our adversaries which in turn lead to demands for more advances. The economy is asked on the one

⁹Additional material on weaponry costs and tactics is contained in C.V. Chester, "Arsenal of Democracy in the Face of Change: Precision Guided Munitions (PGMs) Their Evolution and Some Economic Considerations, Working Paper No. 4," ORNL/TM-11275.

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hand to provide a rapidly advancing technology base on which to create new systems, and on the other, to be prepared at points along the way to multiply production levels to meet conflict needs.

Although it is difficult to quantify differences in weapon performance, Figure 1 illustrates rates of change in one simple parameter, aircraft speed. After aircraft were first used in World War I, speeds increased steadily but marginally even through WW II. The R&D efforts of WW II led to great increases in speed after that war. More increases in speed took place until the practical advantages of faster aircraft in operations were exhausted. Since about 1960, technological advances in aircraft have focused on other parameters, including maneuverability, instrumentation, and most recently, avoiding observation using stealth technology.

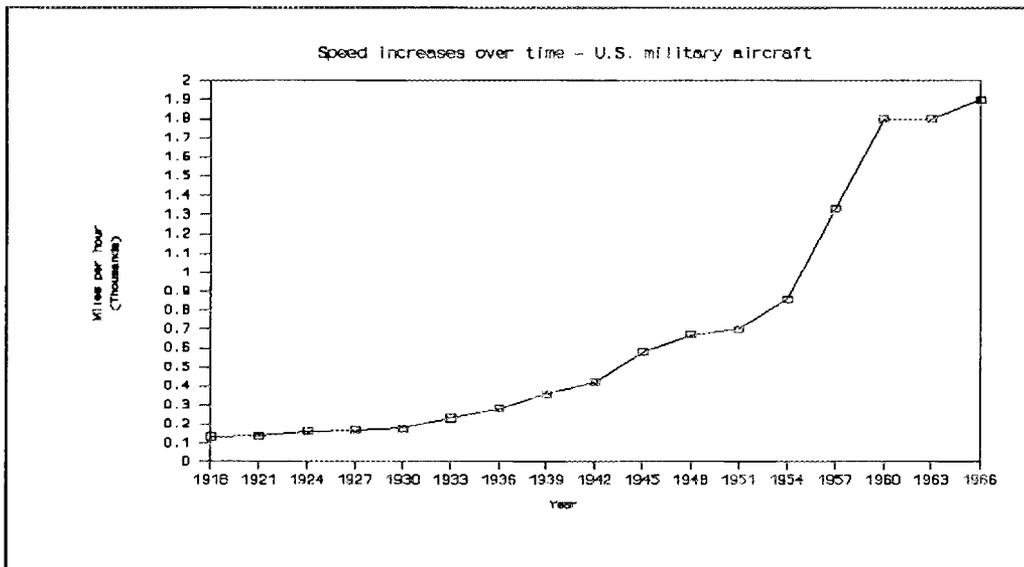


Fig. 1.

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Changes in aircraft performance have been accompanied by great increases in cost, as shown in Table 10. This table compares WW II vintage aircraft with modern aircraft designed for similar missions. Once rough corrections for inflation are made, modern aircraft cost between fifty and 120 times their predecessors, per plane.

Table 10. Escalation of aircraft costs since WW II

WW II Aircraft	Then-Year Cost \$M	1985 Cost \$M ^a Esc. = 5.0	Mission	Equivalent		Ratio Now/WWII
				1985-90 Aircraft	Cost of Equiv., \$M ^b	
B-17	.218	1.09	Penetrating Heavy Bomber	B-1B	97	88
B-29	.680	3.4	Follow-On Heavy Bomber	B-2	277 ^c	82
F-4U	.102	.51	Carrier Fighter	F-18	27.2	53
				F-14 A-C	36.6	72
				F-14D	62.5	123
F-47	.089	.445	Heavy Fighter	F-15 A-E	35 ^d	79
F-51	.054	.27	Light Fighter	F-16 A-D	14.5	54

^a Dollar escalation based on R. S. Means, "Building Construction Costs Data 1985."

^b Costs from T. Nicholas and R. Rossi, "Military Cost Handbook", (9th Ed) Data Search Assoc., Fountain Valley, CA 1988.

^c Aviation Week - 1 February 1988. Later estimates over \$600M.

^d Averaged over fighter classes.

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Table 11. Comparison of munitions' cost by warhead and delivery system components

Class	Warhead	Delivery	Total
Submunition Grenade	50		50
Unitary Shell	1,200	800	2,000
Submunition Shell	2,000	900	3,000
Submunition Rocket	2,000	4,000	6,000
Unitary Bomb	4,000		4,000
Submunition Bomb	12,000		12,000
HI-V/LO-C Missile	3,000	27,000	27,000
HI-C/LO-V Missile	9,000	291,000	300,000
Baby B-1 Missile	18,000	882,000	900,000

Source: TASC, DOD "NATO Munitions Acquisition Strategy"

Aircraft are essentially platforms intended to deliver munitions with which to attack an adversary. The impact of a new generation of munitions technology is illustrated in Table 11 which compares the components of cost for precision guided munitions (PGMs) with those of conventional munitions. Whereas conventional weapons are "delivered" against a target, PGMs are seekers which are first pointed at the target and then make in-course corrections to arrive at the target. Cost increases are primarily related to delivery system performance. The warhead for a baby B-1 (cruise) missile is about the same as for a conventional submunition bomb, but delivery system costs increase the overall cost of the weapon by nearly 40 times.

Innovation and deployment also invite technological competition with adversaries, and the Soviet Union has expended significant resources to maintain rough parity in conventional weaponry. A recent Report of the Defense Science Board (p. 39) compares the technological content of 31 deployed U.S. and Soviet weapon systems. It reports that the U.S. led in 15 categories, trailed in 6, and was roughly equal to the Soviets in 10. The report suggest that the Soviets are gaining in several categories where the U.S. has until recently enjoyed historical advantage.

ECONOMIC CHANGES

DOD and the Economy

Changes in the technical and resource requirements embodied in modern weapon systems have changed the way the DOD interacts with the economy. As a point of reference, Figure 2 illustrates growth in the U.S. labor force, level of employment, non-defense employment, and

Arsenal of Democracy in the Face of Change: Economic Policy for Industrial Mobilization in the 1990s

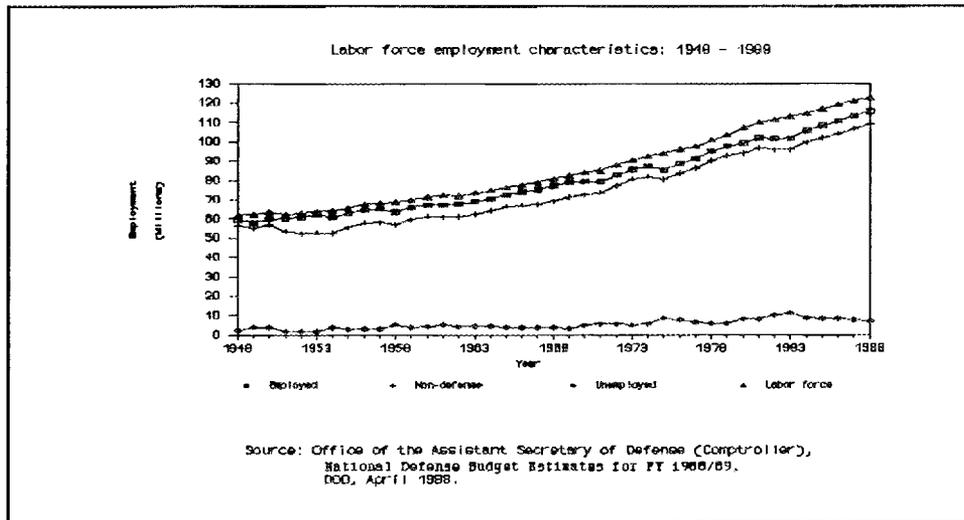


Fig. 2.

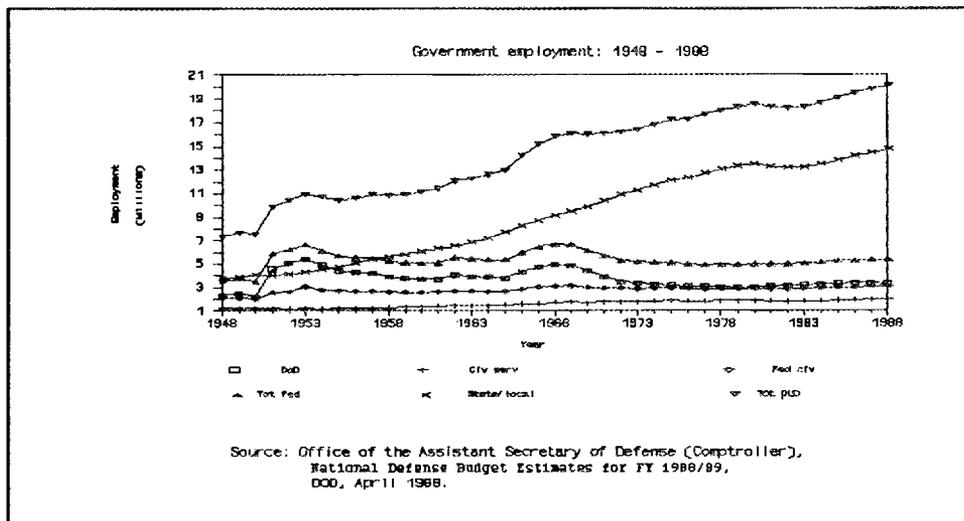


Fig. 3.

unemployment. Figure 3 shows workers employed by the various governments. Since the mid 1950s, the majority of growth in government employment has occurred at the state and local level. Federal Government employment peaked in the early 1950s and again in the late 1960s, largely due to the demands of Korea and Vietnam. Non-defense Federal civil service employment grew until about 1970 and has been relatively steady thereafter.

Figure 4 focuses on the employment impact of the DOD on the economy. It differs from Figure 5 because private sector defense-related employment is added, a group including prime and subcontractor employees. Since Korea, DOD civil service employment has been relatively constant, with changing defense manpower needs met by adding or reducing active military personnel and contractor employees. A striking increase in private defense-related employment began around 1980

at about the same time as the Reagan defense buildup. Currently, DOD supports at least as many workers in the private sector as in the public.

Overall spending levels by DOD vastly exceed those by other Federal Departments, when spending is measured by the purchase of goods and services, rather than tax and transfer activities. As shown in Figure 5, DOD purchases, measured as a percent of GNP, now stand at about 6 percent, roughly half that of state and local government purchases, but about three times more than that for Federal non-defense activities. The nation spends only slightly less on defense than primary and secondary education. In general, DOD is the single largest direct source of jobs in the economy. Industries which wish to sell to the Federal Government are naturally led to DOD.

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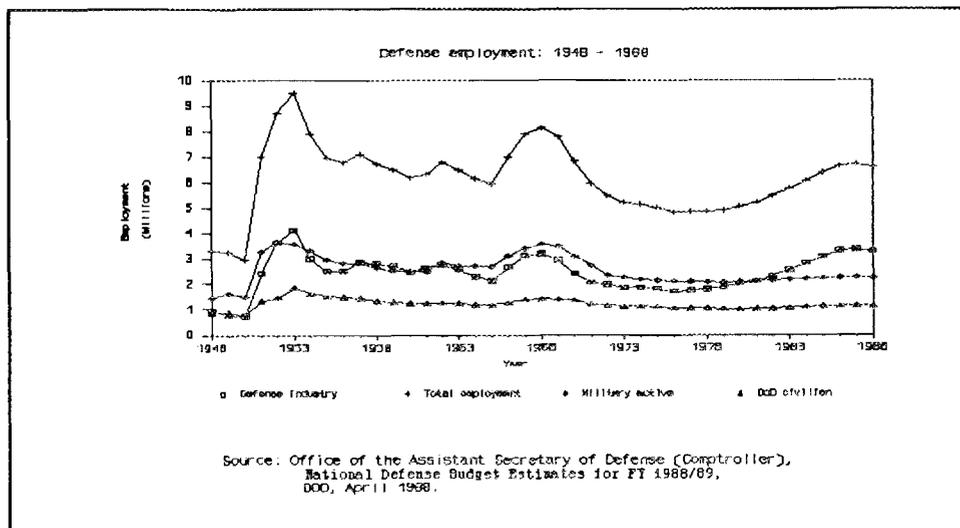


Fig. 4.

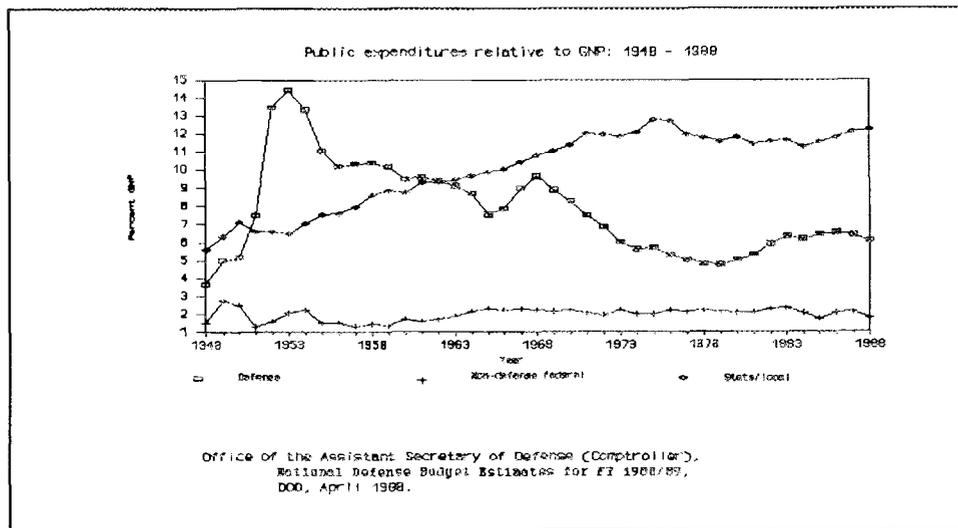


Fig. 5.

To understand the specific impact of DOD on economic behavior requires moving at least to the sectoral level. Table 12 shows purchases for DOD's ten largest industrial supply sectors.¹⁰ Also shown is the share of total DOD purchases accounted for by each sector, the share of each sector's total production purchased by DOD, and the share of sectoral output which is imported.

Together, these purchases account for over sixty percent of all defense purchases, and deal, in general, with communications equipment, aircraft, guided missiles, and ships. In most cases, the DOD is the sector's largest customer, purchasing, for example, about half the output of radio and TV equipment, and half the output of various aircraft sectors.

Offshore Sourcing.¹¹

Although there is considerable concern about offshore sourcing, these data suggest that the vast majority of defense purchases are onshore. All of the sectors shown import less than 20 percent of their product. Stated differently, although entire sectors claim a need for protection to benefit the defense effort, concern in DOD about offshore sources should be focused on individual components rather than on broad sector aggregates. Table 13 indicates the type of dependencies that have raised concern in the past, but one should expect any such list to change

¹⁰Sectoral definitions are taken from the DOD DIEMS modeling system. For further information see DOD, Projected Defense Purchases.

¹¹For additional thoughts on the international implications of weapons supply see, Paul Sullivan, "Arsenal of Democracy in the Face of Change: Issues in the International Economics of Industrial Mobilization and Surge for Crisis in an Interdependent World, Working Paper No. 6," ORNL/TM-11277.

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Table 12. Sectoral impacts of defense purchases

	Value of ^a DOD purchase	% of DOD purchases	% of sector output ^b purchased by DOD	% of sector output ^c imported
Radio and TV Equipment	33649	19.4	50.9	7.2
Aircraft	16999	9.8	55.3	6.5
Aircraft Parts and Equipment	11146	6.4	54.3	17.9
Complete Guided Missiles	9018	5.2	71.9	1.2
Shipbuilding and Repairing	8045	4.6	79.0	5.6
Aircraft Engines	7104	4.1	50.7	19.9
Electronic Measuring Instrument	6616	3.8	18.8	16.4
Chemicals	5372	3.1	n.a	n.a
Electronic Components	5235	3.0	n.a	n.a
Petroleum	5223	3.0	n.a	6.6 ^c
		62.4		

^a1987 Purchase in million of 1986 dollars.

^b1985

^c1980

Source: Compiled from data in Peterson, et al.

Table 13. Pervasive offshore dependencies: U.S. weapons systems

<u>Item</u>	<u>Application</u>	<u>Source</u>
FETs ^a (silicon)	High-frequency radar	Japan
FETs (GaAs)	High-frequency radar	Japan
Ferrite Cores	High-frequency radar	FRG
Glass	Target detectors	Japan FRG
Sapphire	Infrared	Switzerland
Butane triol	Rocket motors	FRG
High-purity silicon	Target	FRG

^aField Effect Transistors

Source: Libicki, p. 52.

rapidly. Typically the list contains specialized items which, while critical to production, make up fairly small proportions of total costs.

Offshore sourcing is frequently explained through a reduction in U.S. economic competitiveness abroad. This is an emotional issue because it raises the specter of offshore citizens replacing U.S. workers, but it is also elusive because the consumption of imported products is so much a part of everyday life as to be commonplace. Predictions of the demise of domestic economic capacity are often based on the following sorts of data. Between 1980 and 1985 U.S. exports dropped from 8.1 percent of total output to 5.2 percent. Over the same period, imports dropped slightly, from 8.9 percent to 8.7 percent. Manufacturing exports dropped more, from 29.5 percent to 22.1 percent of manufacturing output, while manufacturing imports rose from 25.9 percent to 35.7 percent. Individual sectors fared worse and better. Petroleum product exports, for example, remained a flat 17 percent of production while imports dropped from 80 to 57.3 percent. On the other hand, imports of primary metal products grew from 35.3 to 58.9 percent and electronics equipment from 28.2 to 47 percent, while in each case exports dropped. It is thus possible to make a case that the U.S. is faring poorly on the international front.¹² A rather different view of the world position of the U.S. is gained from Figures 6 to 12 inclusive, which present comparative statistics for the U.S. and Canada, Japan, France, Germany, and the United Kingdom.

¹²Data tabulated by Arndt and Bouton (p. 77) from U.S. Department of Commerce, Bureau of the Census, Foreign Trade Division, Report EA275, U.S. Exports; and U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts.

Figures 6 and 7 show that of the group, the U.S. is the smallest participant in international markets relative to its overall economy, but that its participation is growing. Japan, contrary to common belief, participates to a smaller degree in international markets than do the common market nations, which trade extensively with each other. If the common market nations were consolidated their share would appear smaller, even though the same transactions would occur. Actually, international trade among non-defense goods is simply a matter of exploiting economic comparative advantages. The fact that the U.S. is a vast nation, spatially separate from Europe and the Pacific Basin, with significant domestic resources dictates that international trade will play a smaller role in its total overall economic makeup. Trade volume is not in itself a cause for concern. What is a matter of concern for military readiness is assured access to specific items and components of the type shown on Table 13.

A second matter of popular concern is the supposed low rate of U.S. saving. Figure 8 indicates that the U.S. indeed has had a traditionally lower rate of saving than several other nations, but that savings rates are dropping more rapidly for some traditionally high savers, such as France and Germany, than for the U.S. The importance of savings is that it permits domestic investment out of domestic financial transactions. Figure 9 indicates that the U.S. entered the 1960s with the markedly lowest rate of capital formation and ended the period with a rate, still at the bottom on the range shown, but in a much stronger relative position, because of the narrowing of the range.

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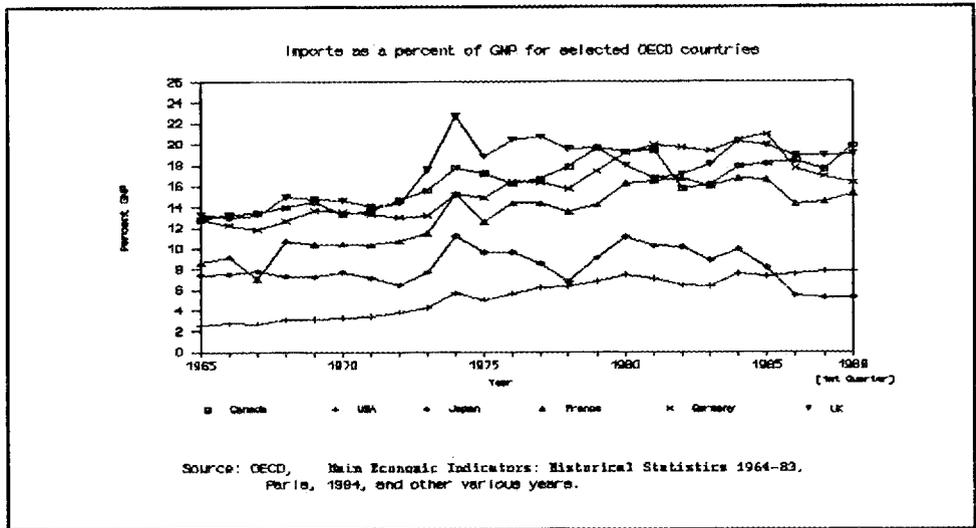


Fig. 6.

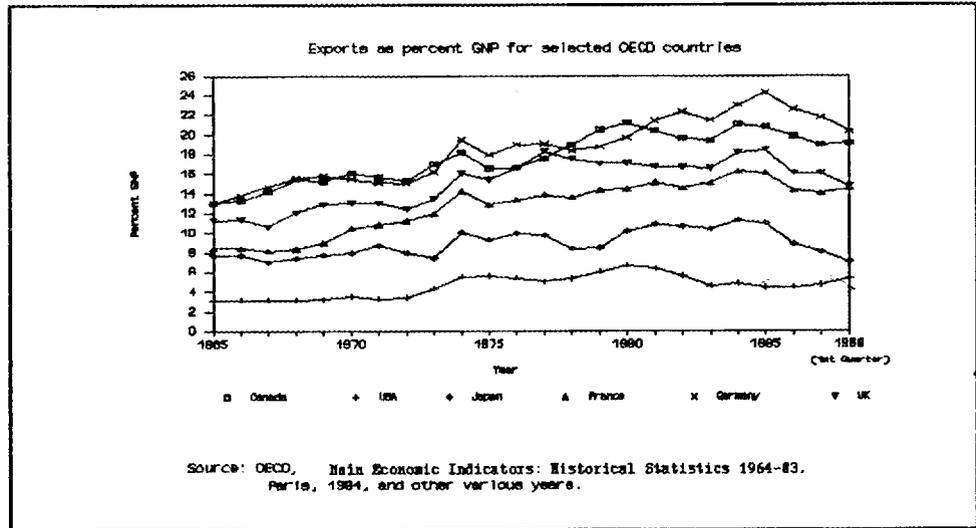


Fig. 7.

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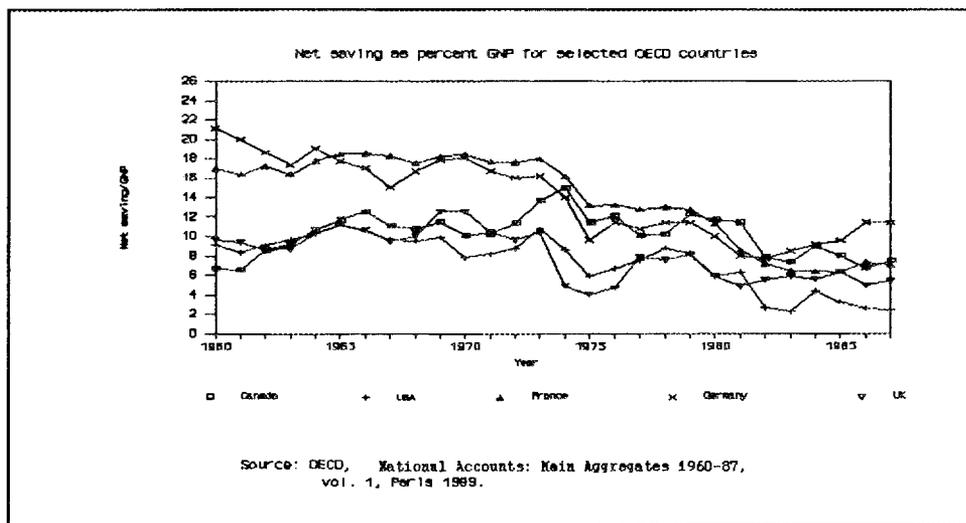


Fig. 8.

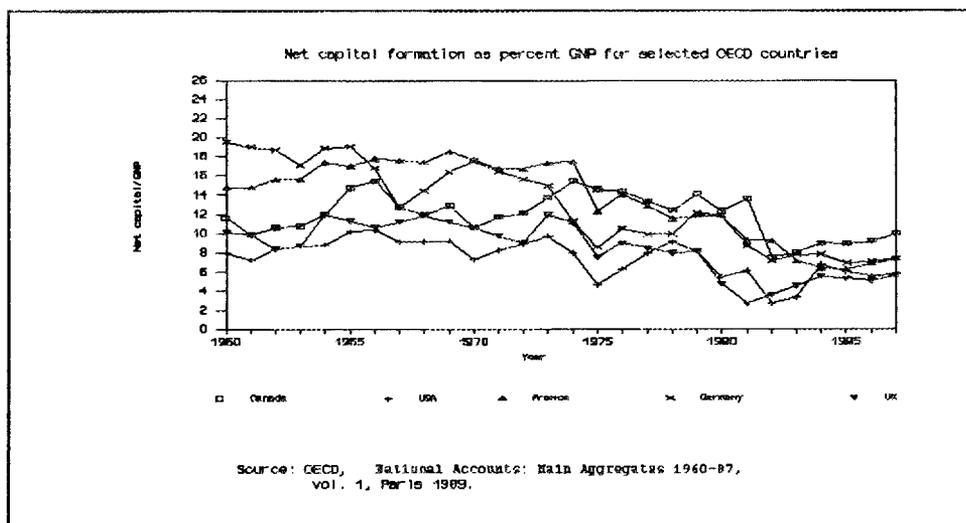


Fig. 9.

Equalization in savings and investment rates can be partially explained by growing similarities in per capita income and demographic characteristics. However, the differences among nations in domestic savings and investment rates, suggest that financial markets, as well as product markets, are becoming internationalized, and that investment funds are flowing into markets where capital is most productive and therefore able to pay the highest rate of return. It is difficult to argue that the U.S. has been hampered in obtaining investment funds, given trends in gross private domestic investment which to some extent overcome definitional problems inherent in the net OECD investment data. Gross private domestic investment in the U.S. was 16.9 percent of GNP in 1980-1988, 16.8 percent in 1970-79, 15.9 percent in 1960-69, and 15.5 percent in 1950-59¹³.

Some of the causes underlying this behavior are shown on Figures 10 and 11. In particular, employment growth in the U.S. (and Canada) was much higher than in the other nations shown, where labor inputs remained almost constant or even dropped. High capital investment rates coupled with low rates of labor growth typically lead to higher rates of productivity, but also to much higher wages. Figure 11 shows that an index of manufacturing wages for the U.S. grew much slower than for the other nations. The bottom line is growth in real GDP, shown in Figure 12. At the start of the period, the "Japanese Miracle" is visible, whereas by the end of the period, growth rates are much more tightly grouped. Germany, even with its very high rate of saving, does not stand out. In fact, toward the end of the period rates are sufficiently similar as to blend together.

¹³See Horwich, *op. cit.*, Appendix A.

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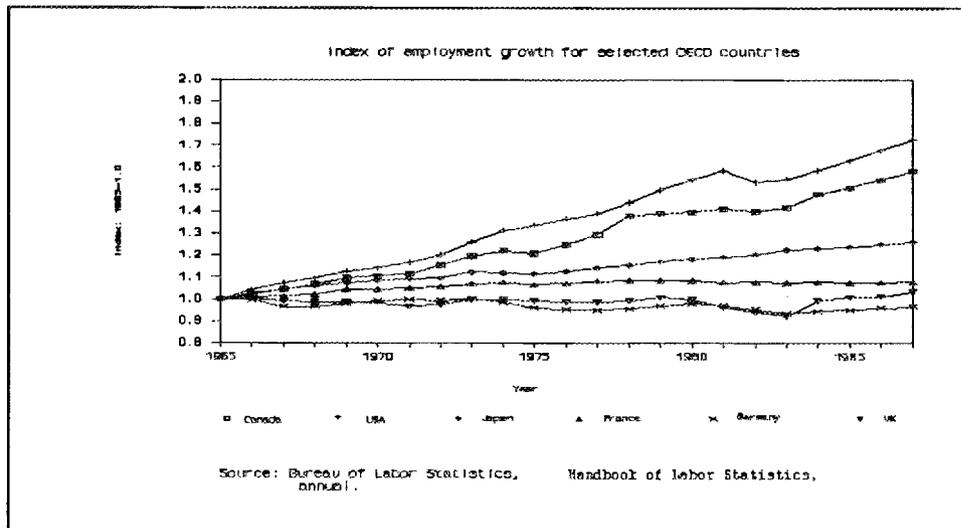


Fig. 10.

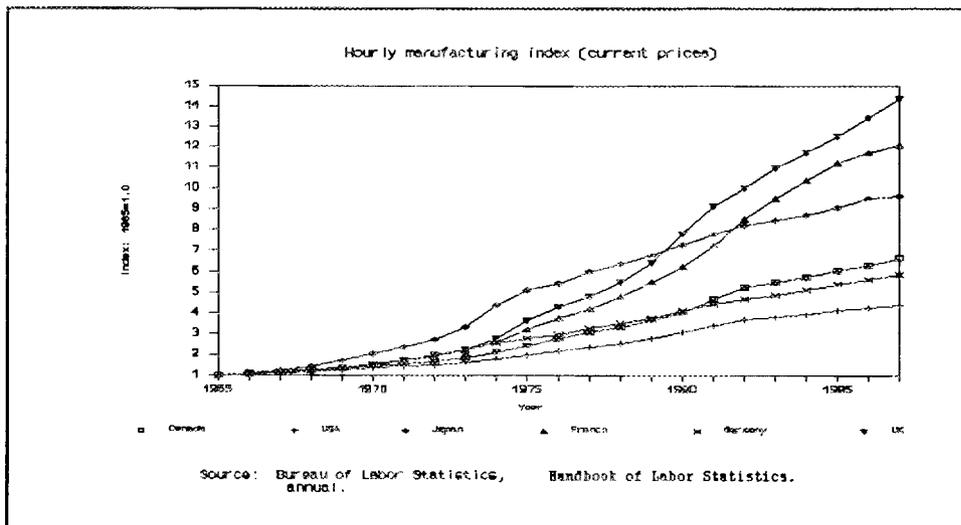


Fig. 11.

These data suggest that the rapid growth of U.S. employment relative to the other nations shown has caused labor productivity and thus wages to grow less rapidly in the U.S. than in other nations. This further suggests that capital productivity in the U.S. has grown relatively, causing rates of return on capital investment in the U.S. to exceed those in other nations and leading to a flow of investment into the U.S. Such a flow causes an increase in the demand for dollars internationally and, coupled with the Federal deficits of the early 1980s and relatively high domestic interest rates, contributed to a strengthening dollar and a reduction in exports.¹⁴

More recent data indicate the international position of the U.S. to be changing again. Figure 13 shows that beginning about 1985, the trade-weighted international value of the dollar began falling. Figure 14 shows that two years later, in 1987, the merchandise trade balance turned up. Though some interpret these changes as a strengthening of the U.S. in world markets, they are a natural consequence of growing international integration and will become more common as ties continue to increase. The weakening of the dollar, of course, is a mixed blessing in that it reflects a reduced flow of investment into the U.S. As of this writing, however, the dollar more recently has shown signs of strengthening, in response to increased capital inflows.

In sum, these data show that the U.S. economy is better positioned for the 1990s than many have argued. GNP growth is strong, largely due to strong growth in labor inputs. Manufacturing

¹⁴This position is argued more strongly in John Tatom, "The Link Between the Value of the Dollar and U.S. Trade and Manufacturing: Some Recent Evidence," *St. Louis Federal Reserve Review*, Nov.-Dec., vol 70, no. 6, pp. 24-37; and K. Alec Krystal and Geoffery Wood, "Are Trade Deficits a Problem?" *St. Louis Federal Reserve Review*, Jan.-Feb., vol. 70, no. 1, pp. 3-11.

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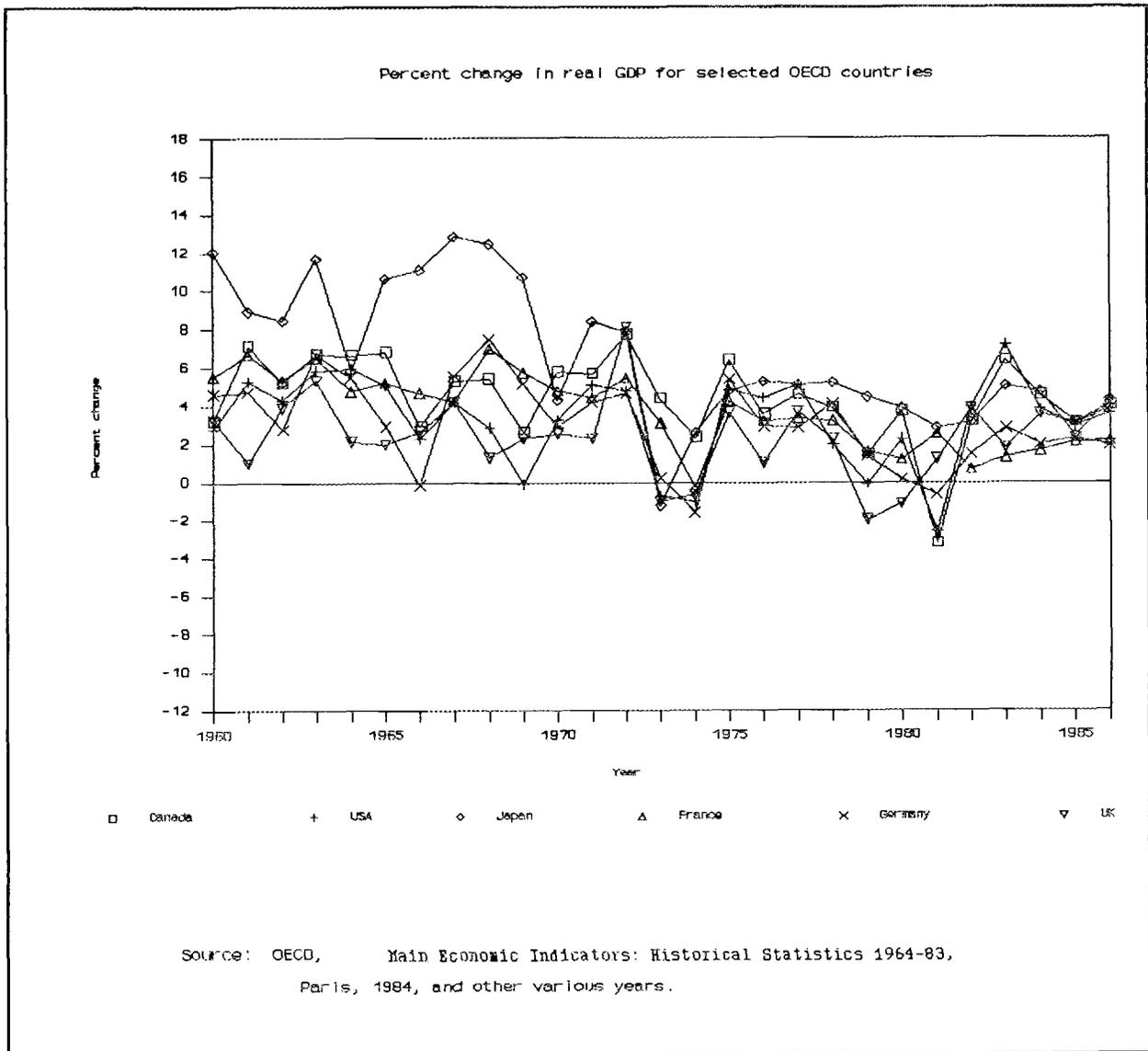


Fig. 12.

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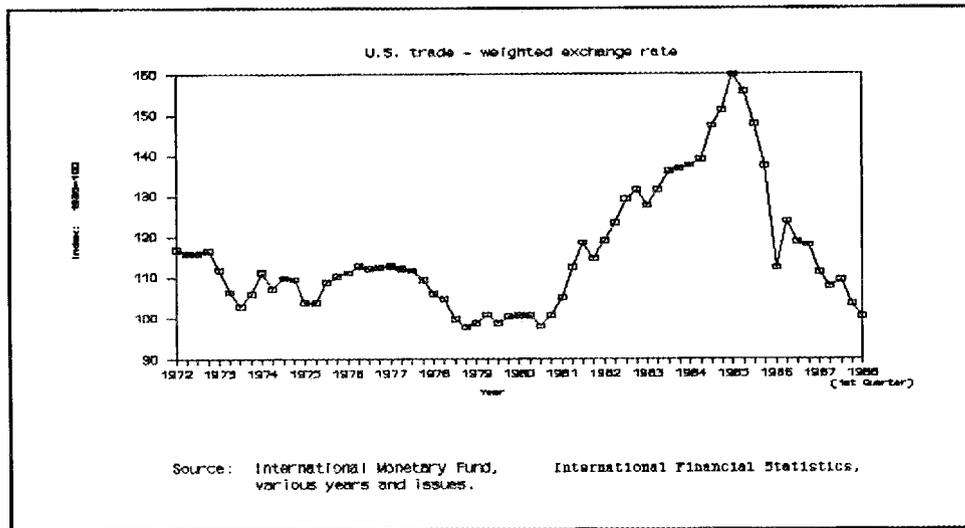


Fig. 13.

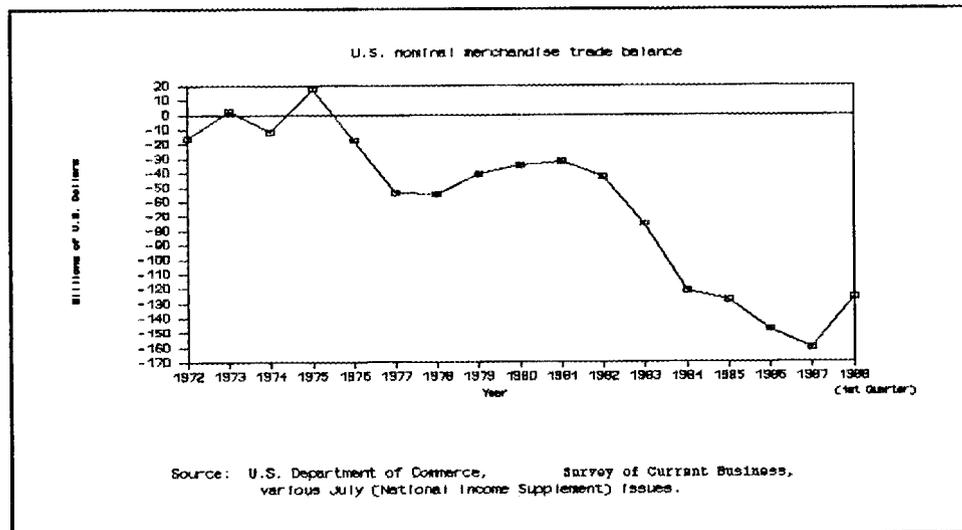


Fig. 14.

wage structures are attractive, and the investment climate is strong. Increases in net capital formation will increase the opportunities to deploy new technologies. Whether or not these optimistic outcomes emerge is dependent on the availability of new technologies and the incentives for firms to put them into place. We briefly consider these issues next.

Technology

Just what constitutes technology and how one measures its constituents have long plagued researchers. The Office of Technology Assessment includes such considerations as

people, institutions, information and skills...a dynamic, interactive network of laboratory facilities, commercial and defense industries, subtier component suppliers, venture capitalists, science and engineering professionals, communications systems, universities, data resources, and design and manufacturing know-how (p. 7).

Technological advance leads to the ability to produce products or processes which improve on the performance of their predecessors. Typically, technological advances are associated with productivity growth and overall rates of economic growth, though this observation is more often asserted than quantified.¹⁵

¹⁵Economic growth is attributable to growth in the factors of production, land, labor, and capital, and to growth in productivity, but measuring the contribution of each component has caused controversy among economists. Dale Jorgenson has recently argued that almost three-quarters of economic growth in the post-war period has been due to factor growth, rather than productivity growth, while others have found that roughly half the growth is due to productivity growth. Often, productivity growth is attributed to growth in technology and growth in technology to levels of R&D, but these connections are very difficult to quantify. See Dale W. Jorgenson, "Productivity and Post-War U.S. economic growth," *Journal of Economic Perspectives*, Fall 1988, vol. 2, no. 4, pp. 23-41.

Much has been made of the distinction between basic and applied research, between research and development, and between the defense industrial technology base and the technology base of the nation as a whole. Little is to be gained by joining this debate, other than to note that the primary difference between defense-only technology and dual-use technology (defense and non-defense) occurs when defense research is classified. This suggests that there is also little difference between domestic dual-use technology and foreign technologies, each being in the general scientific domain. Nevertheless, the private sector, DOD, and the civilian agencies each fund R&D, much of which is quite different from the others, and each benefits from the other's efforts.

For some time the U.S. has been criticized for its lack of fundamental research activities, but some writers believe that this is not an accurate assessment. Ralph E. Gomory, Chief Scientist at IBM, suggests that where the U.S. has failed to be competitive, it has been beaten not by radical new technologies, but by refinements of existing technologies and products (Industrial R&D and U.S. Technological Leadership, p. 10). Nathan Rosenberg endorses this conclusion and points to the internationalization of technology development that has emerged, by noting that the 1986 Nobel Prize in Physics was won by two German scientists working in Switzerland for IBM (*ibid.*, p. 2). A certain level of investment in the fundamental technology base is necessary for innovation, but is insufficient unless tied to management policies that place a premium on application, manufacturability and incremental improvement policies--which many of our offshore competitors, having borrowed from our management textbooks, are now teaching to us in the marketplace.

The MIT Commission on Productivity has reached a similar conclusion. This interdisciplinary body of MIT faculty members recently concluded that while the economy is fundamentally strong, significant adjustments on the part of business and government--leading to more efficient behavior--will be necessary to increase success in international markets. These adjustments include attitudes toward education, teamwork in the workplace, new manufacturing technologies, and the international marketplace (MIT p. 47).

The research funded by DOD has as its goal increased weapons system performance. Most of this research falls under the categories of computer hardware and software, sensors, directed energy, and materials. Individual technologies include robotics, artificial intelligence, superconductivity, and signature controls (stealth). Because much of this work is classified, it is directly unavailable to civilian markets, but in the past many defense-related innovations have been highly adaptable to civilian markets. Some think this will be less true in the future (MIT p. 43). Most DOD research is decentralized in the sense that each Military Department runs its own R&D program, while the OSD attempts to coordinate their efforts. For these reasons, and the general complexity and discontinuous nature of the research process, top level DOD oversight is minimal, and no master plan is evident.

There is little evidence that the U.S. has failed to gain access to needed defense technologies because of the opening of world markets. DOD creates needed innovations, but often does not publicize them, and purchases dual-use technologies in domestic and world markets in the most efficient manner available. While it is arguable that it would be desirable to have all defense-

oriented production processes, and therefore all technology available to domestic producers, it is not clear that to do so by fiat through defense policy would serve the nation's needs.

ACQUISITION CHANGES

The "market" for defense purchases is quite unlike the private markets in which consumers purchase automobiles or food. The major difference is that DOD is a single buyer that interacts with a limited set of direct suppliers (prime contractors) who in turn interact with the remainder of the producing sectors. This results in an arrangement where many of the strengths of the market place that contribute to economic efficiency are ineffective. It also provides a systematic point of access for firms specialized in defense production to bring political pressure to bear on lawmakers to provide protection and subsidies under the guise of national security.

To manage its purchasing, DOD has developed an increasingly more complex and non-integrated acquisition process.¹⁶ The rules guiding this process are contained in some 16,000 pages of Federal Acquisition Regulations plus hundreds of pages of appendices (Gansler 1980, p. 73). The complexity of these rules effectively precludes many parts of the private sector from having direct Government interactions.

The acquisition regulations establish procedures for the relationship between the Government and the private sector in all phases of the procurement process. They generally

¹⁶Jacques S. Gansler has provided a wealth of information and insightful analysis on the mechanisms through which the Department of Defense manages its purchases in his two books The Defense Industry and Affording Defense.

attempt to structure a market-like setting with certain constraints: (1) price competition among firms is mandated; (2) competitive returns to firms winning contracts are minimized by targeting profits as a control variable; (3) disadvantaged or less capable competitors are protected through guidelines, set-asides, and general subsidies; and (4) product parameters referred to as MILSPECs (military specifications) are imposed.

MILSPECs guide the procurement and production of most products purchased by DOD. They are used because of the very unique products required by the DOD, the high standards that DOD imposes, and the need to establish benchmarks against which to measure contractor price proposals and performance. They now guide most DOD purchases, and, in the past have generally precluded off-the-shelf purchases. Today, OSD is searching for new ways to obtain economies from goods available through civilian markets. The major disadvantage of MILSPECs is that they lead to a focus on the manner in which production occurs, rather than the performance of the product produced. In extreme cases, DOD can view contractors as an extension of its own staff and manage them in ways that limit the flexibility of contractors to make independent decisions.

This acquisition system has recently been reviewed by the Packard Commission. Among the Commission's findings were that the private sector should view working with Government as a special mission, with different standards than are typically applied to private sector relationships. It called for new codes of ethics and endorsed more aggressive enforcement of existing and additional rules and regulations (Conduct and Accountability pp. 7-16). Such steps would likely reduce economic efficiency.

A separate set of criticisms concerns the acquisition system's incentives to achieve efficiency (Gansler, 1980, 1989). Defense contractors negotiate profits with DOD on the basis of sales rather than return on investment. This gives the impression of relatively low profit rates but often yields fairly good rates of return on investment. The system provides incentives for contractors to use more Government-owned facilities, equipment, and material and to make fewer internal investments. The Government's emphasis on controlling profits rather than costs means that contractors are not subject to the same incentives to behave efficiently when working for the government as when competing in private markets.

The nature of the budgetary process adds to the fragmentation of DOD purchase decisions. Expenditures are keyed to fiscal years, projected spending rates, and appropriations that may be revised or recalled. Budget instability increases the uncertainty with which contractors must deal and provides incentives to adopt a short term focus unamenable to undertaking independent investment and R&D.

To the extent that DOD creates programs to guide contractors in all aspects of production--production processes, R&D, and investment--it is limited to its own capability for generating efficient behavior. It would be more desirable to allow contractors to make most such choices, making profits a reward for success, and generally encouraging contractors to engage in the same type of innovative behavior that is rewarded in private markets. At present, excessive effort is expended by DOD for the purpose of limiting contractor profits.

Finally, within DOD, decisions to fund surge or mobilization investments are made separately from decisions concerning operations plans. In peacetime, the field commander bases operations plans on a "wish list" of authorized materiel that may or may not be supported by munitions inventories or productive capacities. In wartime, the commander is expected to modify his plans to conform to real capacity constraints. As a result, the wisdom of the field commander is not factored fully into the formation of budgetary priorities.

SUMMARY

This review of changes affecting defense and mobilization policy suggests that while there are many reasons to believe the ability to mobilize will be more important in the future, certain adjustments to policy must be made to sustain and improve that ability.

Changes in U.S.-Soviet relationships will place a premium on mobilization capability, while greater weapon sophistication and cost will make the task more difficult and call for the implementation of increasing cost-effectiveness. The matter is complicated by the growing tendency for defense producers to seek political and popular pressure for subsidies and protection, which is too often granted.

The role of the U.S. in international markets is also changing. This means that many individual firms will find their fortunes similarly changing, sometimes due to forces beyond their control. The U.S. should resist pressures to reverse the forces of these markets, partly because it

can not be done and partly because it should not be done. It is a paradox that Federal policy makers squeeze profits from defense producers that would lead to greater efficiencies, and at the same time seek new ways to subsidize these same producers.

There have been strong calls for DOD acquisition system reform, partly to correct perceived inequities and partly to correct perceived inefficiencies. These goals often compete, as greater emphasis on equity matters adds administrative oversight by Government and reduces contractor flexibility which could permit more innovative behavior if reinforced by positive economic incentives.

V. POLICY FOUNDATIONS AND OPTIONS

It was stated above that the many changes of the past forty years may have weakened the foundations of the nation's defense policy--a policy that dates from a military buildup so successful as to have characterized the entire country the **Arsenal of Democracy**. This document assesses these concerns against the perspective of a U.S. economy that continues to be strong and possesses a defense capability that continues to be effective. Still, there are so many instances when current policy and debate seem out of touch with economic realities, that a review of current policy assumptions, goals, and mechanisms is in order. We suggest a few fundamental findings and options concerning mobilization that contribute to an improved policy.

RETHINKING ASSUMPTIONS

There is no single set of stated assumptions that guides defense policy. However, we believe that there are several perceptions--partially true but incomplete--that arise consistently in discussions of industrial preparedness planning which should be rethought.

IPP is often viewed incorrectly as a micro problem in which success is achieved by building data bases and achieving more complete management control over firms producing defense goods. In fact, modern IPP should be considerably broadened with explicit policy directed at contracting firms, but equally explicit attention focused on defense sectors and the national industrial base.

Current policy permits the military Departments to deal independently with each of the three levels, resulting in a fragmented approach to building surge and mobilization capability.

So confused is this issue that some suggest the only purpose of IPP is to facilitate surge. At present, neither knowledge nor economic capacity is a barrier to surge. The current state of the art permits planning surge in detail, using a JIMPP-like system with a viable data base, and spending the necessary resources to build surge capacity into existing contracts. That this has not been done reflects defense priorities, rather than shortcomings in the defense industrial base.

One reason this fragmentation has occurred is that IPP has been linked intellectually to wartime conditions in which the will of the nation would be galvanized to protect national sovereignty. Under such conditions, it is assumed that unlimited dollars would descend upon the defense effort, and patriotism would purify individual motivation.

Such assumptions lead to policies which underfund preparedness measures and neglect the economic structures that could provide more effective motivation in peacetime. IPP should be integrated into all facets of defense planning, and the transition from peacetime to wartime carefully planned through GMR. Under such practices, it would be clear that warfighting strategies must be linked to levels of production capacity, and that levels of productive capacity should partly determine warfighting strategies. It should be recognized that peacetime institutions create the stock of productive resources available for wartime. DOD has a larger impact on the economy than the rest of the Federal Government, when impact is defined by the purchase of goods and services. To shackle these purchases with an ill-conceived procurement system, which

fails to recognize the essentially economic relationship between DOD and the defense industrial base and which fails to use the profit motive as its prime mechanism to encourage efficient behavior, is to increase significantly the cost of the defense effort.

There remain two misconceptions that underly many of the critiques of the nation's ability to mobilize. The first misconception is that the United States is most secure when it is economically isolated from its allies and world markets. The second misconception is that productive capacity is a surrogate for defense capacity. History belies both positions. Our review of past mobilizations indicates that past defense production buildups occurred slowly, met with mixed success, and were driven by interactions with allies. Over the past several years, the U.S., on net, has benefitted from foreign trade and foreign financial transactions. Today, offshore economic interdependency is a fact of economic life. To recast defense policy as dependent upon a restructured domestic economy opposed to these market forces would increase the cost of the defense effort needlessly and reduce future security by weakening the future economy. Policy should instead seek to exploit the benefits of a more open world economy in which the U.S. is playing and will continue to play a positive role. Defense economic policy should be shaped to accommodate and stimulate rather than resist and inhibit economic change.

Economic capability without consideration of technological capability no longer is sufficient to describe the defense industrial base. In WW II, a preoccupation with steel mills and shipyards was justified. Today, an aircraft with no more materials than its predecessor requires perhaps one hundred times more economic resources to produce. To become sidetracked by nuts and bolts is

to obscure the role of science and technology in the defense effort. There is little evidence that the U.S. is losing access to advanced technologies, though to be successful in an increasingly integrated world, the domestic private sector must remain abreast of its competitors in innovative technical applications. This means that dual-use commodities with extensive technical components may, at times, be available more economically offshore. Policy should recognize this and take steps to secure needed sources of supply, while providing domestic backstops through alternative technologies and inventories.

There are many parties that stand to benefit from government subsidy and protection. Because of the scope of defense activities, these groups have often focused attention on their own abilities to compete and have attempted to equate their own interests with the security of the nation. To evaluate these needs properly, the nation requires an integrated defense planning framework that separates issues and focuses attention properly. The unique position of DOD as a purchaser allows it to dictate contractor profit levels, investment practices, and management procedures. If firms subject to such control consistently fail to meet DOD expectations, the system must be reviewed. The usefulness of an integrated planning framework is that it encourages valid comparisons that allow issues of offshore sourcing, technology, and acquisition to be compared in terms of their economic impacts.

SURGE, MOBILIZATION, AND PREPAREDNESS PLANNING OPTIONS

We turn now to a discussion of policy options. This is conducted in four parts.

A Planning Framework

The first policy concern is an overall planning framework, the basic elements of which are summarized in Table 14 and expanded upon in Tables 15, 16, and 17. The current system is characterized by fragmentation, decentralization, and narrowly pursued self

Table 14. Summary of mobilization planning policy issues

Key Findings:	<ul style="list-style-type: none">- Current system based on IPP with DOD leadership- Current system decentralized and difficult to coordinate- Civilian agencies have minor roles- Many firms/industries seek protection/subsidy
Key Assumptions:	<ul style="list-style-type: none">- Conventional deterrence will increase in importance- DOD will continue marginal improvements, such as <u>Bolstering Defense Industrial Competitiveness</u> recommendations- GMR implementation will continue- DINET data base will be completed but will not support JIMPP- Supply side information will be increasingly incorporated into decisions
Key Policy Options:	<ul style="list-style-type: none">- Restructure IPP to increase involvement of civilian agencies- Review interagency policies for congruity- Refocus policy options on national, sectoral, and firm impacts- Coordinate planning activities to make better use of data and planning overheads

Table 15. Summary of national level policy options

Key Findings:	<ul style="list-style-type: none">- Domestic economy more vital than many critics argue- U.S. international economic relations stronger than many critics argue- no integrated statement of Federal actions on defense capability
Key Assumptions:	<ul style="list-style-type: none">- U.S. will not undertake formal national industrial planning
Key Policy Options:	<ul style="list-style-type: none">- Carry out study to determine impacts of current policy- Create interagency forum for debate of industry issues

Table 16. Summary of sector level policy issues

Key Findings:	<ul style="list-style-type: none">- Current activities focus on protection and R&D- Few current sectoral IPP activities- Little mobilization planning
Key Assumptions:	<ul style="list-style-type: none">- Growing pressures for subsidy under defense rationale- Token voluntary relationships continue- GMR potential vehicle to restore mobilization planning
Key Policy Options:	<ul style="list-style-type: none">- Defense-related sectoral activities led by DOD with interagency participation- Need to relate surge planning to mobilization planning via GMR- Quantify potential contributions of off-the-shelf purchases, manufacturing flexibility, plant conversion capability and other measures to draw on strengths of civilian sectors on mobilization capability

Table 17. Summary of firm level policy options

Key Findings:	<ul style="list-style-type: none">- Bottlenecks are primary action issues- Cost of surge programs may be acceptable- No forum for comparing surge alternatives- Current data bases do not permit proper analysis
Key Assumptions:	<ul style="list-style-type: none">- Policy will continue to require surge- Options should include<ul style="list-style-type: none">- Subsidy- Technical fix- Inventory policy- Weapons choice- Secure foreign sources
Key Policy Options:	<ul style="list-style-type: none">- benefit-cost studies to determine proper surge option by system/item

interest. We believe that the importance of conventional deterrence will increase and that the flow of studies on the topic will continue. DOD will continue to make marginal improvements to its system. Likewise, tools of analysis, such as JIMPP and DINET (and DIEMS) will continue to be used and enhanced. However, this does not constitute an overall framework, and without a framework it will not be possible to judge properly the relative merits of alternative policy proposals properly.

Such a framework should focus attention on the big picture. When a firm comes to Washington and asserts that its survival is vital to the national interest, its claims should be viewed with extreme skepticism. Although its products may be vital to a narrow range of DOD goals, that is a different matter. When defense R&D is justified because of past beneficial spinoffs, its claims

should be discounted highly. The national importance of specific R&D can only be judged against the larger national interest, and in that context a variety of fundamental R&D activities could be justified.

The goal of this planning framework should be to separate issues of firm, sector, and national relevance, to identify and estimate the impact of existing Federal policies and procedures on each, and to create a forum among interested parties in which this could be discussed. The nation currently needs to reduce inefficiencies caused by programs that subsidize individual groups, a practice that an appropriate planning framework would help to avoid.¹⁷

DOD would play a dominant role in this planning activity, because it is the major purchaser in the Federal government. It should draw together its tools--GMR, JIMPP, the PBAs, and its procurement system--and represent its interests strongly. But it is not the only player. Other agencies of government also have vital interests and, more importantly, vital skills in attacking these issues. One would expect DOD to exercise hegemony over its contractors, to contribute strongly to sectoral issues, and to participate, though not necessarily lead, in matters of national economic concern. For example, as the Federal government establishes new research centers they should be placed under Departmental auspices on the basis of expertise, rather than expediently being allocated to DOD.

¹⁷Blinder provides a persuasive argument that a multitude of such small subsidies has significantly reduced the efficiency of the overall economy.

There are three key elements to this framework. For national issues, the long term economic interests of the nation's economic future are paramount. Defense policy should be driven by, rather than drive, these interests. At the sectoral level, the capability of civilian economic capacity, relative to defense economic capacity, could be considered. At present, there is not enough consideration of the ability to mobilize, that having been supplanted by attention to ability to surge. The interest in mobilization must be renewed. At the firm level, DOD should examine options to meet goals. DOD should carry out cost-benefit studies of such options as inventories, technical fixes (e.g., flexible manufacturing systems), and securing international acquisition, rather than accepting subsidization as a first-priority option.

Policies Dealing with Acquisition/Private Sector Interactions

Table 18 presents a summary of public/private sector interactions. We find that the current system is plagued by multiple goals that work against efficient behavior and by an attitude within DOD and fostered throughout the government that one should use contractors as an extension of in-house staff, that contractors should seek explicit permission to make investments and other business decisions, and that profits should be tightly controlled. The same administrators who seek to save the public money by controlling profits often seek public subsidy for firms that are having difficulty competing. It would be much more sensible to allow effectively competitive firms to earn even "excessive" profits working for the Government, if the result were to reduce overall costs.

The system would benefit from being recast as a purely business relationship between the Government and the private sector aimed at controlling costs by tying the firm's profits and losses

Table 18. Summary of policy options for DOD/private sector interaction

Key Findings:	<ul style="list-style-type: none">- Current acquisition system burdened by multiple goals- Current system treats contractors as DOD extension, under DOD direction- Current system leads to less innovation and investment than desirable- Current system shapes defense industry
Key Assumptions:	<ul style="list-style-type: none">- <u>Bolstering Defense Industrial Competitiveness</u> recommendations adopted- DOD will remain primary point of contact with private sector, with some authority delegated
Key Policy Options:	<ul style="list-style-type: none">- Federal government should promote a revised acquisition system<ul style="list-style-type: none">- Profit oriented- Efficiency oriented- Less direct DOD control and intervention- Less emphasis on price competition

to performance. Clearly, there would have to be rules of the game concerning ethics and fair play, but these should be essentially the same rules as apply to private sector firms doing business with one another. In general, the same review of management principles now underway in the private sector should be extended to the public sector.

Policies Dealing with Technology and Factor Enhancement

These policy options are summarized in Table 19. Among the key findings are that even while the nation has a vital technology base, there is often confusion on how to develop separate criteria guiding defense-related R&D and R&D intended to benefit the economy generally. Once

Table 19. Summary of policy options for technology and factor enhancement

Key Findings:	<ul style="list-style-type: none">- Technology policy has impacts on national, sector, firm levels- At national level DOD technology and civilian economy much alike- At sector level technologies more specialized, often classified- At firm level DOD funds specific R&D projects- Critics often confuse ability of U.S. economy to produce defense technology with ability to market civilian technologies- DOD appears to have access to needed technologies
Key Assumptions:	<ul style="list-style-type: none">- Weapons systems continue to be technology driven- Future dual use technologies will be world-wide
Key Policy Options:	<ul style="list-style-type: none">- Separate technology issues into national, sectoral, and firm levels- Integrate defense R&D policy with national R&D policy- Set goals for each kind of policy, and target programs for maximum effect<ul style="list-style-type: none">- performance- producibility- limited access- Consider new general purpose R&D institutions

again, critics have confused the occasional failure of individual private sector firms in international markets with the nation's lack of access to defense technologies. There is little evidence that the nation is handicapped in access to vital technology, just as there is much evidence that individual firms in the private sector must adopt new procedures to compete more effectively abroad. But these are separate issues.

The key objective here is to separate issues properly and focus attention on the specific goals of each level of issues. It would appear that the ability of the nation to surge or mobilize

would be greatly benefitted by R&D policies aimed at manufacturability. Likewise, great benefits would accrue to tying normal development cycles with technology that would facilitate rapid buildups, such as requiring compatibility through flexible manufacturing systems. Finally, thought should be given to the creation of new, semi-autonomous research institutions which could serve a range of Federal and national R&D interests.

Policies Dealing with Offshore Sourcing

Table 20 summarizes policies dealing with offshore sourcing. We find that while potential vulnerabilities due to offshore sourcing are a genuine concern, the assumption that all defense production must occur onshore may no longer be valid. In particular, specific causes of vulnerability should be identified--shipping, technology, cooperation--and related to specific DOD goals. DOD should develop methods to evaluate alternative means of reducing these vulnerabilities for each specific item under consideration. A variety of methods exist to do this, including inventory policies, flexible manufacturing systems, and means of securing offshore channels. In any event, these issues exist individually as concerns at the firm level, even though the state of the national economy will naturally have implications. Temptations to apply sector-wide or nation-wide policies to deal with nuts and bolts issues should be avoided.

Table 20. Summary of policy options for offshore sourcing

Key Findings:	<ul style="list-style-type: none">- Current acquisition policy uses offshore sources to gain economy- Without specific security measures, offshore sourcing can increase vulnerability- Eliminating offshore sources for specific components increases costs- National level policies sought by industry for protection/subsidy
Key Assumptions:	<ul style="list-style-type: none">- U.S. can continue to gain advantage by using offshore sources- Means exist to secure offshore sources
Key Policy Options:	<ul style="list-style-type: none">- Develop methods to evaluate benefits and costs of offshore sources relative to more costly onshore sources- Choose practice on individual basis- Resist industry-wide policies to solve nuts and bolts problems

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LIST OF ACRONYMS

C³I - Command, Control, Communication, and Intelligence.
CIL - Critical Items List.
CINC - Commander in Chief.
DEF - Defense Spending.
DEFCON - Department of Defense/Defense Conditions.
DINET - Defense Industrial Network.
DOC - Department of Commerce.
DOD - Department of Defense.
FEMA - Federal Emergency Management Agency.
GDP - Gross Domestic Product.
GMR - Graduated Mobilization Response.
GNP - Gross National Product.
IMIP - Industrial Modernization Incentive Program.
IPP - Industrial Preparedness Planning.
JIMPP - Joint Industrial Mobilization Planning Process.
MANTECH - Manufacturing Technology Program.
MILSPEC - Military Specifications.
NADIB - North American Defense Industrial Base.
NATO - North Atlantic Treaty Organization.
NSC - National Security Council.
OECD - Organization for Economic Cooperation and Development.
OJCS - Organization of the Joint Chiefs of Staff.
ORNL - Oak Ridge National Laboratory.
OSD - Office of the Secretary of Defense.
PBA - Production Base Analyses.
PGM - Precision Guided Munitions.
R&D - Research and Development.
SEMATECH - Semiconductor Technology Research Institute.
USD/A - Undersecretary of Defense for Acquisition.

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