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DEFENSE SPENDING, CALIFORNIA EMPLOYMENT AND THE STATE'S FUTURE

By

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Acknowledgments

The decision to develop our research into a full length paper began with a request from Peter Asmus, John Kirlin and Jeffrey Chapman that we contribute a chapter to their edited volume, California Policy Choices. This working paper is a draft of the paper to be completed for their volume later in 1993. At the University of California, we received comments and research support from faculty and research assitants at the Center for Real Estate and Urban Economics. Among the most significant contributions were research support by Ayse Pamuk, Michael Cunningham, Bruce Fukuji, and Brendan Daniels and a careful critique of the econometric model offered by Dwight Jaffee. Josh Kirshenbaum of the Institute of Urban and Regional Development, engaged in a parallel research effort, shared resources with us.

Beyond the university, many people in the defense industry, in research organizations, and in state agencies were very helpful to our work. These include Martha Alcott of Aerojet, Charlotte Chamberlain of Wedbush Morgan Securities, Philip Coyle of Livermore National Laboratory, Michal Dyer of Sandia National Laboratories, Michael Gage of CALSTART, Bertha Gorman of Lockheed Corporation, Mim John of Sandia National Laboratories, Marie Jones of the Center for Economic Conversion, Linda Kimball of the San Jose Office of Economic Development, Gus Koehler of the California Research Bureau, Tom Miller of the San Diego Private Industry Council, Patricia Noyes of the California Trade and Commerce Agency, Gene Plevyak of Space Applications Corporation, Eric Rosenfeld of Joint Venture: Silicon Valley, Bob Sakai of the Alameda County Office of Economic Affairs, Lynn Sedway of Sedway and Associates, Charlene Simmons of the California Research Bureau, Steven Spickard of Economics Research Associates, George Stepaneko of Condor Systems, and Brad Williams of the Commission on State Finance.

In conducting this research, we have had to summarize and condense a great deal of information. We have tried to maintain a balance among the various topics to be covered and to summarize without distorting information, but the authors are responsible for any errors.

Caveat

This analysis has been carefully conducted based on the most recently available data. Unfortunately, during the period of research, the California Employment Development Department and the U.S. Bureau of Labor Statistics were struggling to correct some serious data errors in their employment series. We incorporated revisions made in March, June and September 1993 into the analysis. Any revisions made beyond mid-September have not been incorporated. ***The type of data most sensitive to error, given the data uncertainties and our own estimation methods, are the data on the parts of the state outside of the Southern California and San Francisco Bay Areas***, as these are often treated as a residual in our analysis.

DEFENSE SPENDING, CALIFORNIA EMPLOYMENT AND THE STATE'S FUTURE

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ABSTRACT

Through a look at historical trends, current activity and projections of future employment levels, this paper examines the impacts of cuts in the national defense budget on the California economy. Declining defense spending has already led to a loss of 160,000 jobs in defense manufacturing and civilian Department of Defense employment since 1988. With multiplier effects, the slowdown in defense-related sectors may be responsible for close to half of the jobs lost in California during the 1990-92 recession.

Defense manufacturing jobs have historically been tied to the level of defense prime contracts received by California firms and to national economic growth rates. We estimate an econometric model of this relationship to forecast future employment levels. Assuming that California maintains at least a 16 percent share of future prime contracts, we predict that job losses in these sectors will begin to abate over the next 4 years. Nevertheless, the state may lose an additional 24,000 to 55,000 defense manufacturing jobs during this period. On the other hand, if out-migrating firms and shifting allocations of prime contract dollars leave California with a far lower share--12 percent, for example--the state may lose as many as 80,000 more jobs in defense manufacturing by the end of 1997. In addition to any losses in defense manufacturing employment, base realignments are likely to remove about 35,000 Department of Defense civilian jobs from the California economy.

Firms, federal programs, and state and local agencies are all focusing on efforts to recover from defense cuts. Firms are engaged in efforts at consolidation, conversion, or diversification. These efforts may allow firms to continue to operate, but are unlikely to lead to the replacement of jobs already lost in defense sectors. Federal programs focus on the goals of maintaining a viable defense industry and helping communities and workers adjust to cuts in the employment base. State programs are aimed at coordinating a variety of federal, state agency and local resources and at improving the California business climate.

The research concludes that in the long run California has many opportunities for continued economic growth, especially in the areas of advanced technological manufacturing and services. However, the next few years will continue to be a period of adjustment, with job recovery occurring at a slow pace. Strengthening the basic resources of the state--its education system and infrastructure--will be as important as any programs designed specifically for the defense industry or defense-impacted communities in leading to long term growth of a diversified economy in California.

DEFENSE SPENDING, CALIFORNIA EMPLOYMENT, AND THE STATE'S FUTURE

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

DEFENSE SPENDING, CALIFORNIA EMPLOYMENT, AND THE STATE'S FUTURE:

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Executive Summary

Introduction

Defense spending has been important in shaping the state's economy and played a significant role in the state's strong recovery from the 1982 recession. Spending cuts since 1988 have been a major contributor to the severity of the 1990-92 recession in California. Will the expected further cuts over the next few years cripple California's economic recovery, or can the losses be counteracted by growth in other industries? How will the California economy evolve as defense spending begins to play only a minor role in income and output?

The Shrinking Role of Defense Spending

Defense spending in California (for both prime contracts and military activity) equaled 17 percent of Gross State Product (GSP) during the Vietnam war, 9 percent of GSP during the build-up of the Reagan years, and about 7 percent of GSP in 1992. If proposed cuts continue, defense spending will equal only 3 percent of GSP in 1997. Direct employment in defense manufacturing sectors and civilian Department of Defense (DOD) jobs represented 19.7 percent of manufacturing jobs and 4.6 percent of all jobs in California in 1988. These shares had dropped to 15.2 percent of manufacturing and 3.3 percent of all jobs by 1993. If multiplier effects are taken into account the role of defense in the economy is greater (in addition to direct employment, this would include the jobs generated by spending of defense sector firms and employees in the general economy). With multiplier effects, defense spending accounted for over 9 percent of total employment in 1990, but possibly for close to half of job losses between 1990 and 1993. ***In total, almost 160,000 jobs have been lost in defense manufacturing and civilian DOD employment in California since 1988. Multiplier effects may have led to the loss of an additional 200,000 jobs during the same period.***

Uncertainty Surrounds the Level and Impacts of Future Cuts

State projections suggest that future losses (through 1997) may be almost as severe as those that have already occurred--an additional 90,000 manufacturing jobs and 36,000 DOD civilian jobs. However, our own analysis, based on econometric techniques, indicates that this is a "worst case" scenario. The additional loss of defense manufacturing jobs over the next 4 years may be as low as 24,000 jobs, if moderate recovery occurs in national GNP growth and if the prime contract cuts experienced by California are no worse than those occurring in the rest of the nation. If this more optimistic projection occurs, then ***job losses from cuts in civilian DOD employment, which have been small compared to manufacturing job losses to date, may be larger than defense manufacturing job losses from 1993 to 1997.***

The Uneven Geographic Spread of Impacts

The impacts of defense spending cuts have been spread unevenly throughout California. Southern California, with over four-fifths of the state's defense manufacturing employment, experienced by far the greater share of job losses in defense manufacturing. ***Close to 90 percent of defense manufacturing job losses have occurred in Southern California.*** Northern and Central California have far larger shares of DOD civilian defense jobs than defense manufacturing jobs. ***Base closure has meant little in the way of loss for San Diego and Los Angeles counties, while the northern California counties have and are expected to continue having far more than their proportional share of DOD civilian job cuts.***

Recovery from Cuts and Industry Structure

Past history suggests that "defense conversion" may not be a smooth process for firms, employees, or communities. Large, vertically integrated firms accustomed to dealing with government contracts rather than competitive markets have been found to have difficulty converting to commercial products. Missiles, aircraft, and to some extent search and navigation firms are most likely to reflect this type of firm structure. These are the sectors that dominate the defense portion of the Southern California economy. Communications equipment firms, concentrated particularly in Silicon Valley, have tended to have a more flexible firm structure and may be able to shift more smoothly to a commercial setting. Nevertheless, ***to characterize the largest defense employers as "dinosaurs," unable to change, is misleading. Many firms have been undertaking adjustment strategies for several years.***

The Range of Adjustment Strategies and Implications for California--The Private Sector

Responses of defense firms to cuts follow a wide range of strategies, from attempting to remain solely defense oriented, to completely leaving the defense industry, to attempting to work in both worlds. Some firms are remaining defense oriented, waiting out the period of cuts by diversifying their product lines within defense and/or concentrating on products for which demand is still growing (e.g. surveillance equipment). Other firms are converting some product lines to produce goods suited to commercial markets. Still others are diversifying through the purchase of new product lines (defense or commercial) from other firms. Many defense firms are likely to survive the period of cuts through these strategies. However, ***the strategies do not necessarily lead to net new job creation, nor do they necessarily lead to strengthening or maintaining California branches of the firms.*** Diversification of Hughes Aircraft, for example, has led to the expansion of facilities out-of-state and the closure of some major California facilities.

Adjustment Strategies for Base Closure

Until recently, historic experience with base closure in California has been as discouraging as early efforts to convert defense firms. A combination of environmental problems and community disagreements have led to the abandonment of some of the bases closed in the early 1970s. More recently, greater congressional oversight of base closure decisions and a more systematized Federal response program have paved the way for some more successful transitions. The easiest base reuse planning has occurred where the base has been transferred to another Federal agency. However, other examples also exist in California of bases where communities were able to agree on a single vision for the future of the base and where the DOD was able to make decisions that accounted for environmental constraints.

Most of these cases are still in the planning stages but appear likely to lead to successful reuse of the bases. ***Many of the bases currently scheduled for closure are on prime real estate in California and offer significant development opportunities as the general economic climate improves. Key issues which remain to be addressed are the impacts of the transition period on the civilian employees who have lost their jobs and on the businesses most directly dependent on the base population.***

Combining Resources through Joint Ventures

The loss of defense jobs has been severe enough that both firms and communities have recognized that recovery will depend on more than individual actions and programs. A number of different types of joint ventures address the immediate or long term issues arising from recovery. Immediate needs are addressed by organizations such as the San Diego Private Industry Council, which has done a comprehensive study of the San Diego industrial base in order to inform employers of the retraining needs and transition options for displaced defense workers. Long term development has been addressed by organizations such as CALSTART, which with both private and public funding is attempting to support the development of new, technologically advanced industries in California. More local needs such as networking to strengthen an existing industrial node are being addressed by organizations such as Joint Venture: Silicon Valley. ***While these efforts are unlikely to be significant job producers in the short run, they are important in directing the longer term development options within the state.***

Federal, State and Local Roles in Adjustments to Defense Cuts

The Federal government plays a very significant role in determining how firms, communities, and joint ventures respond to defense cuts. Existing Federal programs have already helped to shape the diversification and technology transfer efforts of individual firms and are influencing the programs of organizations such as CALSTART. ***The state has made large strides towards developing a defense recovery effort that coordinates local, state and Federal programs. In addition, broader decisions on infrastructure and education spending will certainly affect the rate at which the state's economy recovers and the types of firms that continue to expand in the state.*** For local governments, limited resources make the direction of effort critical. For example, communities that have focussed their resources on fighting base closures and fighting neighboring jurisdictions for the right to plan for closed bases have been much less successful in having a reuse plan accepted than those communities that are able to accept the fact of closure and work closely with neighboring jurisdictions in reaching an agreement.

The Outlook for Recovery

Defense, while a critical element in the current downturn, is not the only key element of the California economy. The prospects for long term recovery will be influenced by many other sectors of the economy, and by many economic linkages beyond the DOD budget. Nevertheless, the downsizing of the defense sector is and will continue to affect the state's rate of recovery. California in the 1990s may continue to grow more slowly than the U.S. economy as a whole, a contrast to the experience of the 1980s. Even so, recovery is beginning to appear in some services sectors and in some non-high tech manufacturing sectors.

DEFENSE SPENDING, CALIFORNIA EMPLOYMENT, AND THE STATE'S FUTURE

California's experience with job growth and unemployment since 1990 has clearly demonstrated the state's economic dependence on defense spending. With close to 20 percent of U.S. prime contracts allocated to California, defense spending in the state has accounted for a very significant share of gross state product during periods of war (World War II, Korea, Vietnam) and during other periods of defense build-up. While representing only a small proportion of direct employment in the state today, defense spending cuts, directly and indirectly, may account for close to half of jobs lost in California since 1990.

This degree of dependence on defense activity raises serious questions about the state's ability to recover quickly from the 1990-92 recession. A pessimistic scenario would be the following. ***Much of California's apparent strength in the 1980s was a result of economic expansion due to defense expenditures. The state's recovery from the 1982 recession would have been much slower without the defense expansion occurring during the 1980s. Because defense spending is expected to fall further in the 1990s, no similar injection into the California economy can be expected to help the state's recovery from the 1990-92 recession. Furthermore, earlier research suggests that defense firms are ill-suited to conversion efforts. They are large, vertically integrated, and accustomed to producing to Federal specifications rather than in a competitive setting. Thus, this industry will have little to offer the state in terms of resources for growth in the future.*** This scenario suggests that the continuing loss of defense jobs may cripple California's economic recovery and eventually lead the state to slip from being a major producer of high income, skilled jobs to being a state with growth of lower income employment sectors to match the skills of an expanding immigrant labor force.

This pessimistic scenario can be contrasted to more optimistic viewpoints, such as that suggested by recent forecasts by the Center for the Continuing Study of the California Economy.[1] An optimistic view would argue that ultimately California can recover strongly from the defense cutbacks. ***The loss of defense jobs is not without cost to California. Jobs being lost are higher wage jobs, often requiring technical or professional training. However, there are a number of bright elements remaining in the California economy. First, despite its relatively heavy dependency on defense, the state has a highly diversified economic base. Other strong sectors include non-defense high-tech, emerging biotechnology fields, trade, tourism and entertainment. The defense industry, while it contributed to the development of some of these sectors, also more recently has been a limiting factor to growth of nondefense sectors. The drops in defense spending will allow for the investment of resources in other parts of the California economy. These resources may range from Federal funding of defense technology transfer projects, to the allocation of military bases to civilian uses, and to the improved availability of skilled labor and housing in California's major urban centers. In addition, the characterization of defense companies as dinosaurs that cannot survive in the modern age is an exaggeration. These firms have been focusing on survival for at least half a decade. Many will continue in defense or expand into other sectors, though not necessarily choosing to expand within California.*** Under this scenario, California's ability to recover and grow again economically will depend upon how well it makes use of the new resources that are becoming available and how well it maintains the existing resources (from education to infrastructure) that fueled much of its earlier growth.

This paper looks at the role of defense in California's economy and the likely effects of far lower defense spending levels on California's future. The paper begins by examining the size and structure of defense sectors in California and their likely patterns of growth over

the next half-decade. This exercise is followed by an examination of the prospects for recovery from a decrease in defense spending, with an emphasis on conversion, diversification, resource reuse, and other alternatives. The paper closes with a discussion of the choices facing the state, community, local and private sector levels that will affect the long term impacts of defense cuts on the state's economy.

Previous Cycles of Defense Spending in California

California has experienced several periods of defense buildups followed by defense cuts. Defense contracts played an important role in shaping the state's economy during the second World War, the Korean War, and the Vietnam War, as well as during President Reagan's eight years in office. Defense spending was responsible for bringing heavy industry to California during World War II and for contributing to the state's expanding high technology industry in later periods. During these expansion periods defense spending was equivalent to a large share of the state's gross state product (for example, as much as 17 percent of GSP during the Vietnam War).

Even in periods of high military spending, defense sectors were far from being the only source of strength of the state's economy. During the 1960s, prime contracts awarded to California defense firms reached a peak of $25.9 billion (in 1992 dollars), and total defense spending in California peaked at $50.4 billion (1992 dollars) in 1968.[2] Yet the ratio of defense spending to GSP dropped from 17 percent in 1963 to 14 percent in 1969, because other sectors of the state's economy had grown more rapidly.[3] In the 1980s, defense spending represented an even smaller proportion of the state's economy. Defense expenditures in California reached a new peak of $60.4 billion (in 1992 dollars) in 1988, 20 percent above the 1968 level. Because of the strength in other sectors of the state's

economy, this amount was equivalent to less than 9 percent of GSP.

The magnitude of the current cut-backs in defense spending are not unprecedented. Between 1968-69 and 1973-74, defense spending in California dropped by 30 percent, and the defense-spending-to-GSP ratio shrank from almost 15 percent to just over 8 percent. In contrast, between 1988 and 1992, defense spending has dropped by only 16 percent , and the defense spending/GSP ratio dropped from 9 percent to about 7 percent. However, expected cuts over the next four years, combined with recent cuts will be larger than in the 1968 to 1974 period. California's Commission on State Finance predicts that spending may drop by an additional 36 percent between 1992 and 1997. With this decrease, defense dollars will only represent 3 percent of GSP by 1997 (see Figure 1). This would leave the state's economy with the smallest presence of defense spending (in relative terms) in more than three decades.

The situation today differs from earlier periods in other ways besides relative magnitude. The current round of defense cuts has occurred in a period when California is experiencing its worst recession since the 1930s. This has compromised the state's ability to reabsorb workers laid off from defense occupations. Furthermore, the defense sector's role in California's economy will be far slimmer than it has been in any other recent period. This may affect the quality of jobs, labor skills, income levels, and research and development efforts in California in the future.

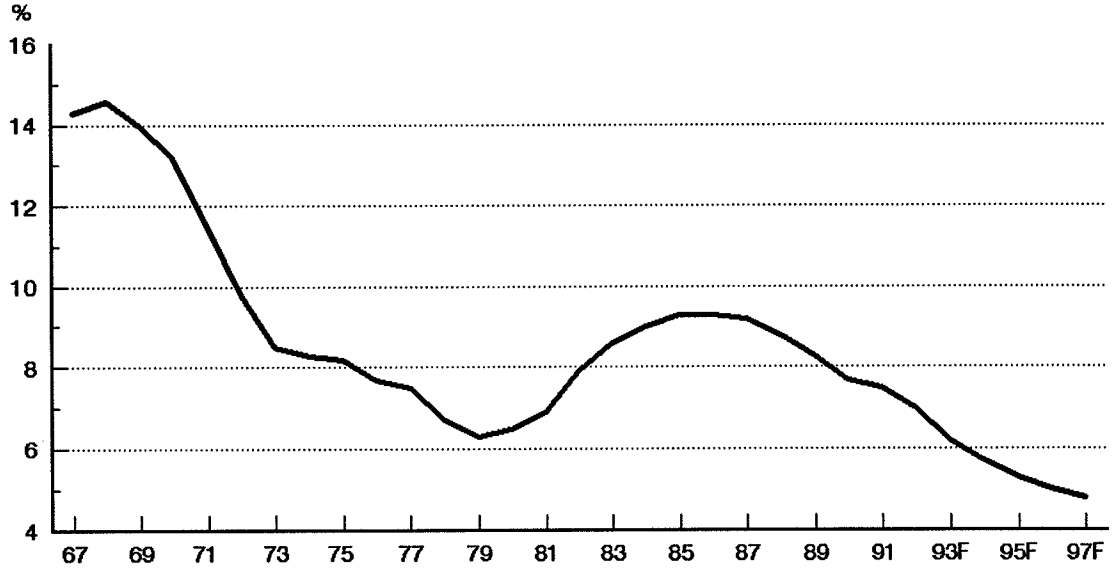
The Defense Industry in California's Economy

How large a role has the defense industry played recently in shaping California's economy? Defense spending has affected California's economy through military and civilian jobs with the Department of Defense (DOD), through companies contracting to provide

Figure 1

Defense Spending in California

Ratio of Defense Spending to Gross State Product



Source: CA Commission on State Finance

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products or services to the DOD, and indirectly, through expenditures of DOD employees and contractors on goods and services in the state. While aerospace and ordnance (weapons and ammunition) are the best known industries selling products to the DOD, the fifty largest prime contractors in California also include such diverse activities as health care providers, universities, insurance companies, construction companies, oil companies and utility companies.[4] For some of these firms, the DOD represents only a small portion of their business. Industries most commonly characterized as "defense industries" are sectors where a high proportion of shipments (20 percent or more) are to the DOD or related agencies.[5] In California, these are largely manufacturing sectors, including at the 3-Digit SIC code level, ordnance (SIC 348), communications equipment (SIC 366), aircraft and parts (SIC 372), shipbuilding (SIC 373), missiles and space equipment (SIC 376), and search and navigation equipment (SIC 381).[6] Some of these sectors are only partially dependent on defense (for example, search and navigation equipment has relied on the DOD for one fifth to one third of its shipments) while others are almost entirely dependent on defense (e.g. two-thirds to four-fifths of missile and space shipments are to Federal defense agencies).[7]

In 1988, before defense spending cuts began affecting the job base, over 400,000 manufacturing workers were employed in these six defense related manufacturing sectors in California (see Table 1).[8] In addition, 135,500 civilians were employed directly by the Department of Defense (DOD) in California during that year (primarily at military bases). The defense-related manufacturing jobs accounted for 3.5 percent of total (public and private) nonagricultural employment in the state in 1988. Including DOD civilian jobs, the defense sector in California accounted for 4.6 percent of all state jobs. While this was a relatively small proportion of total jobs, a much larger proportion of manufacturing jobs were dependent on defense sectors. In 1988, 19.7 percent of all manufacturing jobs in California were in

Table 1: California Employment for Defense Industries, 1988-1993.

SIC INDUSTRY	EMPLOYMENT 1988	1990	1992	1993	CHANGE 1988-90	1990-92	1990-93	1988-93	PERCENT CHANGE 1988-90	1990-92	1990-93	1988-93
348 Ordnance & Accessories	5,984	4,830	4,277	4116	(1,154)	(553)	(714)	(1,868)	-19.28%	-11.44%	-14.78%	-31.22%
366 Communications Equipment	30,900	30,500	29,200	28528	(400)	(1,300)	(1,972)	(2,372)	-1.29%	-4.26%	-6.47%	-7.68%
372 Aircraft and Parts	159,600	162,300	132,000	109363	2,700	(30,300)	(52,937)	(50,237)	1.69%	-18.67%	-32.62%	-31.48%
373 Ship Building & Repairs	13,100	12,600	11,900	10902	(500)	(700)	(1,698)	(2,198)	-3.82%	-5.56%	-13.48%	-16.78%
376 Guided Missiles & Space Vehicles	79,900	75,700	58,200	48042	(4,200)	(17,500)	(27,658)	(31,858)	-5.26%	-23.12%	-36.54%	-39.87%
381 Search and Navigation Equipment	123,600	99,300	84,600	71906	(24,300)	(14,700)	(27,394)	(51,694)	-19.66%	-14.80%	-27.59%	-41.82%
Total Defense Manufactoring	413,084	385,230	320,177	272,857	(27,854)	(65,053)	(112,373)	(140,227)	-6.74%	-16.89%	-29.17%	-33.95%
DOD Civilian Jobs	135,500	130,600	121,800	116,300	(4,900)	(8,800)	(14,300)	(19,200)	-3.62%	-6.74%	-10.95%	-14.17%
TOTAL DEFENSE	548,584	515,830	441,977	389,157	(32,754)	(73,853)	(126,673)	(159,427)	-5.97%	-14.32%	-24.56%	-29.06%
Nonagricultural Employment	11911500	12499900	12140400	11961004	588,400	(359,500)	(538,896)	49,504				
Manufacturing Employment	2096700	2068800	1889600	1800172	(27,900)	(179,200)	(268,628)	(296,528)				
Share of Nonagricultural Employment												
Defense Manufacturing	3.47%	3.08%	2.64%	2.28%		18.10%	20.85%	N/A				
Total Defense	4.61%	4.13%	3.64%	3.25%		20.54%	23.51%	N/A				
Share of Manufacturing Employment												
Defense Manufacturing	19.70%	18.62%	16.94%	15.16%	99.84%	36.30%	41.83%	47.29%				

Notes: 1. Numbers in parantheses are negative.
2. 1993 employment data based on percentage change in 5 month average for 1992 to 1993.

Source: California Employment Development Dept., June 1993 Benchmark Revisions, yearly averages, 1983-1992.
(ordance numbers for 1988-1991 are from county business pattern
(ordance numbers for 1991 thru 1993 are estimates based on the percentage change in employment in SIC 34 (Fabricated Metals) in the EDD series from 1990.)

defense dependent sectors--primarily aircraft and parts, missiles and space vehicles, search and navigation equipment, and communications equipment.

Compared to other parts of the nation, California has had a relatively high share of defense spending and of defense sector jobs. Since the late 1960s, California has received 17 to 23 percent of defense prime contracts awarded each year.[9] In 1988, the state had 11.3 percent of the country's nonagricultural jobs (11.7 percent of agricultural jobs[10]), but 38.4 percent of missiles and space jobs, 39.1 percent of search and navigation equipment jobs, and 23.5 percent of aircraft and parts jobs, as shown in Table 2. Overall, California had almost one fourth of the nation's defense manufacturing jobs and 14 percent of DOD civilian jobs.

The state's dependence on defense jobs extends significantly beyond the key manufacturing sectors and civilian military employment described so far. In addition to these manufacturing sectors, other portions of the state's economy are affected directly and indirectly by defense expenditures. Nationally, estimates by the Bureau of Labor Statistics (BLS) indicate that 57 percent of private sector jobs generated by defense spending in 1992 were in nonmanufacturing sectors (up from 52 percent in 1987).[11] Such comprehensive estimates for California are not available. However, estimates of "multiplier effects" of spending and employment in key defense sectors, from an input-output model of the California economy, give a partial picture of the size and composition of linkages.

Defense dollars spent in California generate jobs and income not only directly in the weapons and equipment producing sectors but also through the purchases by defense contractors of services and supplies from other firms, and through the spending patterns of defense workers. An input-output analysis of the California economy, which calculates spending and employment linkages among industrial sectors, estimates that each defense job

Table 2: California Share of U.S. Employment, by Defense Sector, 1988

SIC	Industry	United States	California	California as Share of U.S.
	Total Non-Agricultural	105,210,000	11,911,500	11.3%
	Total Manufacturing	19,314,000	2,096,700	10.9%
348	Ordnance and Accessories	77,300	5,984	7.7%
366	Communications Equipment	274,600	30,900	11.3%
372	Aircraft and Parts	683,500	159,600	23.4%
373	Ship Building and Repair	195,600	13,100	6.7%
376	Missiles, Space Vehicles	208,000	79,900	38.4%
381	Search and Navigation Equip.	316,000	123,600	39.1%
	Civilian DOD	964,100	135,500	14.1%

Sources: United States figures - Bureau of Labor Statistics
California figures - California Employment Development Dept.
California figure for SIC 348 is from County Business Patterns

can generate as many as two additional jobs in the state economy.[12] As shown in Table 3, the communications equipment sector has the highest multiplier effect of the defense sector (the multiplier of 2.95 implies that an additional 1.95 jobs are produced for every job generated within the sector). The lowest multiplier effects are for Department of Defense civilian jobs (with only an additional 0.72 jobs generated for each job in the sector). The additional jobs created through the multiplier effects of defense spending include other defense manufacturing jobs, nondefense manufacturing jobs, and nonmanufacturing jobs. When multiplier effects are taken into account, the share of state jobs impacted by the defense sector rises from 4.6 percent to over 10 percent for 1988.[13]

These numbers offer a rough estimate of the importance of defense spending to employment in the state, rather than a polished, complete analysis. Not all jobs in "defense manufacturing" are generated by Federal defense allocations (some are related to civilian markets), while some jobs directly related to defense spending occur in other manufacturing and nonmanufacturing sectors which are not discussed here (e.g. jobs related to electric utility services to bases).

Defense related jobs in other manufacturing and nonmanufacturing sectors, because of their relatively small share of each sector, are difficult to track over time below the national level, although these jobs are certainly important to the state economy. Furthermore, the greater diversification within these sectors makes quick recovery from defense cuts more likely. For these reasons, the discussion which follows focusses only on defense manufacturing sectors and on civilian jobs at military bases. We look at the changes in total employment levels without attempting to distinguish defense-related from nondefense jobs within these "defense" sectors.

Table 3: California Employment Multipliers for Defense Sectors For Direct, Indirect and Induced Employment

Sector	Multiplier
Ordnance	2.12
Communications Eqp.	2.95
Aircraft	2.48
Missiles	2.01
Shipbuilding	2.25
Search and Navigation Eqp.	2.34
Federal Military	1.72

Source: Goldman and Pradhan, U.C. Berkeley Department of Agricultural Economics, February 1993.

Defense Sector Job Losses Since 1988[14]

Defense related sectors of California's economy have been losing jobs since the late 1980s, a period when the state's economy overall was continuing to grow. Between 1988 and 1990 total nonagricultural employment in California grew by 4.9 percent, while employment in defense sectors dropped by 32,800, or about 5.8 percent. Most of these early losses were concentrated in one sector, search and navigation equipment, which lost almost 20 percent of employment and accounted for 87.2 percent of all defense manufacturing jobs lost. Other sectors had much smaller losses or gains, as shown in Table 1.

Employment losses increased sharply in the 1990s. Using data released in June 1993 by the Employment Development Department, we estimate that California lost over 110,000 defense manufacturing jobs between 1990 and 1993, a drop of 29.2 percent, and 14,300, or 10.9 percent of, DOD civilian jobs. During this period, search and navigation equipment continued to lose jobs rapidly, while two other large defense manufacturing sectors, aircraft and parts and missiles and space vehicles, began losing jobs at an even faster pace. From 1990 to early 1993, defense jobs accounted directly for almost one quarter of all job losses in the state and for over two fifths of manufacturing job losses.

There is no way to exactly measure the degree that losses in defense sectors have contributed to the severity of California's recession. Defense cuts certainly generate impacts beyond direct job losses. Taking multiplier effects into account, defense manufacturing and civilian DOD employment accounted for 9.1 percent of all nonagricultural jobs in California in 1990, as shown in Table 4. If defense job cutbacks were accompanied by full multiplier effects, then as much as half of the total job loss since 1990 may be the consequence of defense sector losses.

However, the full multiplier effects of job losses may not have been felt yet, if, for

Table 4: California Defense Industry Employment Change with Multiplier Effects, 1988 - 1993

SIC	INDUSTRY	DIRECT EMPLOYMENT IN DEFENSE 1988	1990	1992	1993	Job Mult.	TOTAL JOBS CREATED 1988	1990	1992	1993	JOB CHANGE WITH MULTIPLIERS 1988-90	1990-92	1990-93
348	Ordnance & Accessories	5,984	4,830	4,277	4116	2.12	12,686	10,240	9,067	8,726	(2,446)	(1,172)	(1,514)
366	Communications Equipment	30,900	30,500	29,200	28528	2.95	91,155	89,975	86,140	84,158	(1,180)	(3,835)	(5,817)
372	Aircraft and Parts	159,600	162,300	132,000	109363	2.48	395,808	402,504	327,360	271,220	6,696	(75,144)	(131,284)
373	Ship Building & Repairs	13,100	12,600	11,900	10902	2.25	29,475	28,350	26,775	24,530	(1,125)	(1,575)	(3,821)
376	Guided Missiles & Space Vehicles	79,900	75,700	58,200	48042	2.01	160,599	152,157	116,982	96,564	(8,442)	(35,175)	(55,593)
381	Search and Navigation Equipment	123,600	99,300	84,600	71906	2.34	289,224	232,362	197,964	168,260	(56,862)	(34,398)	(64,102)
	Total Defense Manufactoring	413,084	385,230	320,177	272,857		978,947	915,588	764,288	653,458	(63,359)	(151,299)	(262,130)
	DOD Civilian Jobs	135,500	130,600	121,800	116,300	1.72	233,060	224,632	209,496	200,036	(8,428)	(15,136)	(24,596)
	TOTAL DEFENSE	548,584	515,830	441,977	389,157		1,212,007	1,140,220	973,784	853,494	(71,787)	(166,435)	(286,726)
Share of Nonagricultural Employment													
	Defense Manufacturing	3.5%	3.1%	2.6%	2.3%		8.2%	7.3%	6.3%	5.5%		42.1%	48.6%
	Total Defense	4.6%	4.1%	3.6%	3.3%		10.2%	9.1%	8.0%	7.1%		46.3%	53.2%
Share of Manufacturing Employment													
	Defense Manufacturing	19.7%	18.6%	16.9%	15.2%		NA	NA	NA	NA			
Total Nonagricultural Employment		11911500	12499900	12140400	11961004		11911500	12499900	12140400	11961004	588,400	(359,500)	(538,896)
Total Manufacturing		2096700	2068800	1889600	1800172		2096700	2068800	1889600	1800172	(27,900)	(179,200)	(268,628)

Notes: 1. Numbers in parantheses are negative.
2. 1993 estimates are based on the percentage change in the 5 month average for 1992 to 1993.

Source: California Employment Development Dept., June 1993 Benchmark Revisions, yearly averages, 1988-93
(ordance numbers for 1988 and 1990 are from county business patterns.)
(ordance numbers for 1993 is estimate based on percentage change in SIC 34 from 1990.)

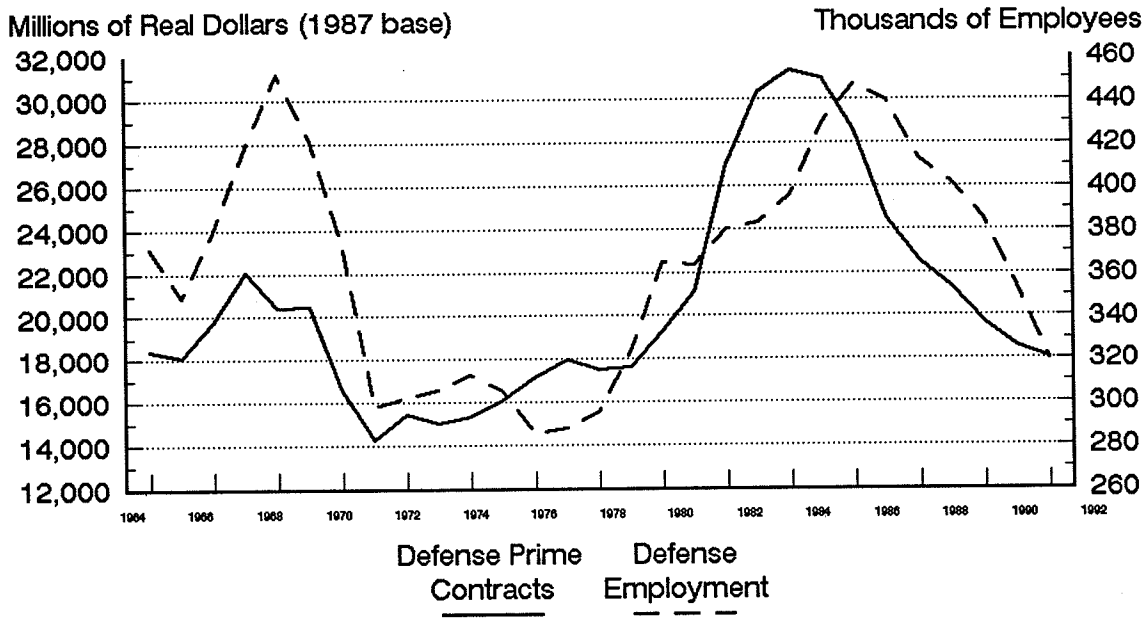
example, suppliers continue to employ a full workforce as they search for new customers, or if laid off employees continue to spend income in the state using unemployment benefits or savings as alternative sources of income. Also, some of the job losses in the defense manufacturing sectors may relate to nondefense subportions of these sectors.[15] On the other hand, the figures reported here could underestimate the defense cutback role in the recession in other ways. The estimate does not include changes in military personnel based in California (as opposed to civilian DOD employment), which also would generate direct and multiplier effects on the California economy. Nor do they include changes in direct employment in other manufacturing and nonmanufacturing sectors generated by defense spending for equipment other than weapons and for services. Within these uncertainties, it is clear that the impact of defense cuts in California's recession is significant, accounting for well over one fourth and perhaps as much as half of the job losses.

Estimating Job Losses Beyond 1993

Forecasting job losses beyond 1993 requires identifying the factors underlying employment levels within defense manufacturing sectors and estimating how changes in these factors could bring about defense sector employment change. While levels of prime contracts awarded to California will be one significant factor influencing employment levels, observation of firm behavior and historic trends in employment suggest other factors are also influential. In determining employment levels, defense firms respond not only to the level of prime contracts for the present year, as is evident from Figure 2, but also to other considerations--especially their desire to maintain stable employment levels within the firm and their general expectations about the economy, which would influence the non-defense portion of their customer base. A simple econometric model incorporating these characteristics relates

Figure 2

Defense Prime Contracts and Manufacturing Jobs California, 1964-1992



Source: CREUE from California Commission on State Finance and EDD.

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employment in defense manufacturing sectors in the current year with employment in the previous year, current contract levels, and general economic conditions as demonstrated by the rate of change of GNP (see Appendix A for a detailed explanation of the structure of the model and underlying assumptions in forecasts). Although simple, the model is quite powerful. All three factors are strongly statistically significant, as shown in Table 5. The predicted employment levels derived from the model track historical employment quite closely, as seen in Figure 3.

The model results raise important questions about the level to which defense manufacturing employment has dropped in 1993. The model predicts 1993 defense manufacturing employment levels in the range of 290,000 jobs or more. An estimate of annual average employment for 1993 based on trends for the first half of the year would leave employment at about 272,000, while the actual level for the first half of the year is about 285,000. Why has job loss "overshot" its expected level? Several alternative explanations are likely. One is that California firms actually received a much smaller share of defense prime contracts in 1993 than they had received previously, either due to changes in reporting of classified contracts or as a result of out-migration of firms (see Appendix A). A second explanation is that defense firms have ceased to try to match earlier levels of employment and have become more sensitive to expected decreased contract levels in the future--thus they are anticipating a long term level of lower employment and are cutting jobs early to meet this expectation, rather than continuing to try to maintain historic averages which are no longer feasible.

Given these possible structural changes, forecasting from this model must be done with caution. A baseline estimate using this econometric model suggests that while further losses will occur, they may be much less than the losses of the past five years. If the national

Table 5: Regression Model of Defense Manufacturing Employment

Dependent Variable - $LEMP_t$
N = 27

Variable	Coefficient	
CONSTANT	1.314 (1.72)	
$LEMP_{t-1}$	0.659 (6.63)	
$LCON_t$	0.247 (3.75)	
$USGNPCH_{t-1}$	1.265 (2.96)	R-squared = .841 p = .3

The numbers reported in parentheses are the t-statistics for the coefficients. The variable p is the estimated value of the autocorrelation coefficient.

The variable are:

$LEMP_t$ is the log of total California employment in year t in six defense related industries: ordnance and accessories (SIC 348), communications equipment (SIC 366), aircraft and parts (SIC 372), ship building and repair (SIC 373), guided missiles and space vehicles (SIC 376), and search and navigation equipment (SIC 381).
$LCON_t$ is the log of total prime contracts awarded to California in year t. (measured in constant 1987 dollars)

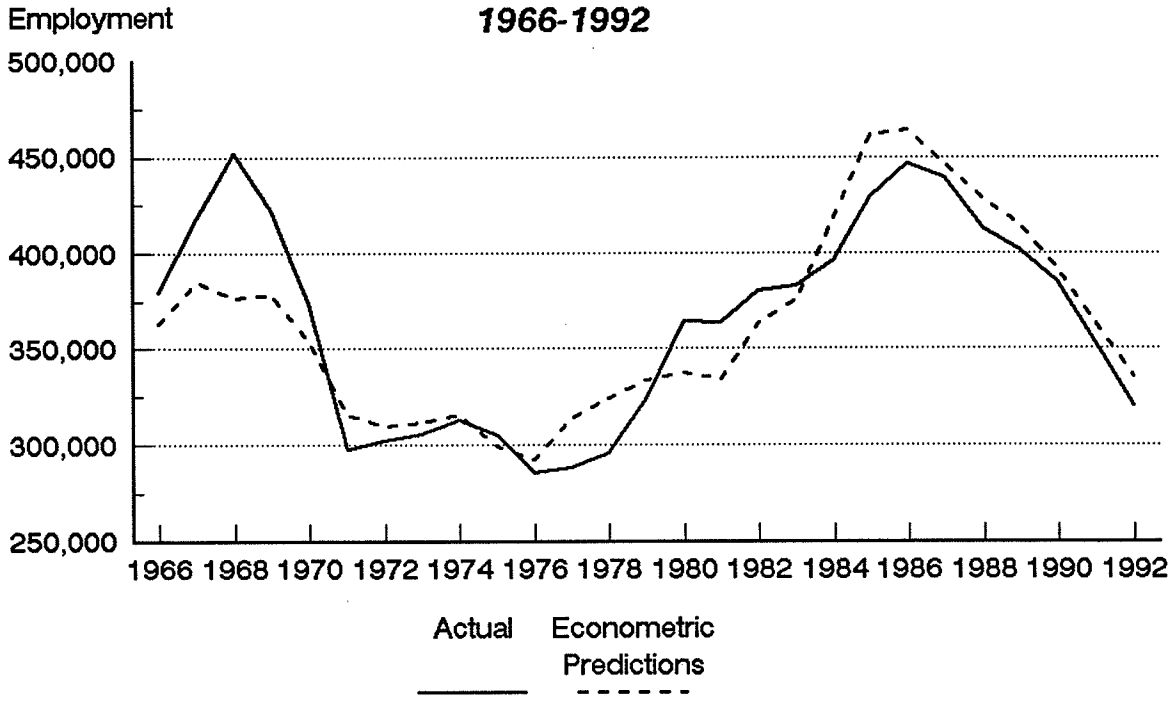
$USGNPCH_{t-1}$ - The percentage increase in Gross National Product (also measured in 1987 dollars) in the year t-1.

Further discussion of the development of this model and its use for forecasting is contained in Appendix A.

Figure 3

Actual and Predicted Defense Employment

1966-1992



Source: County Business Patterns, California EDD, and CREUE estimates.
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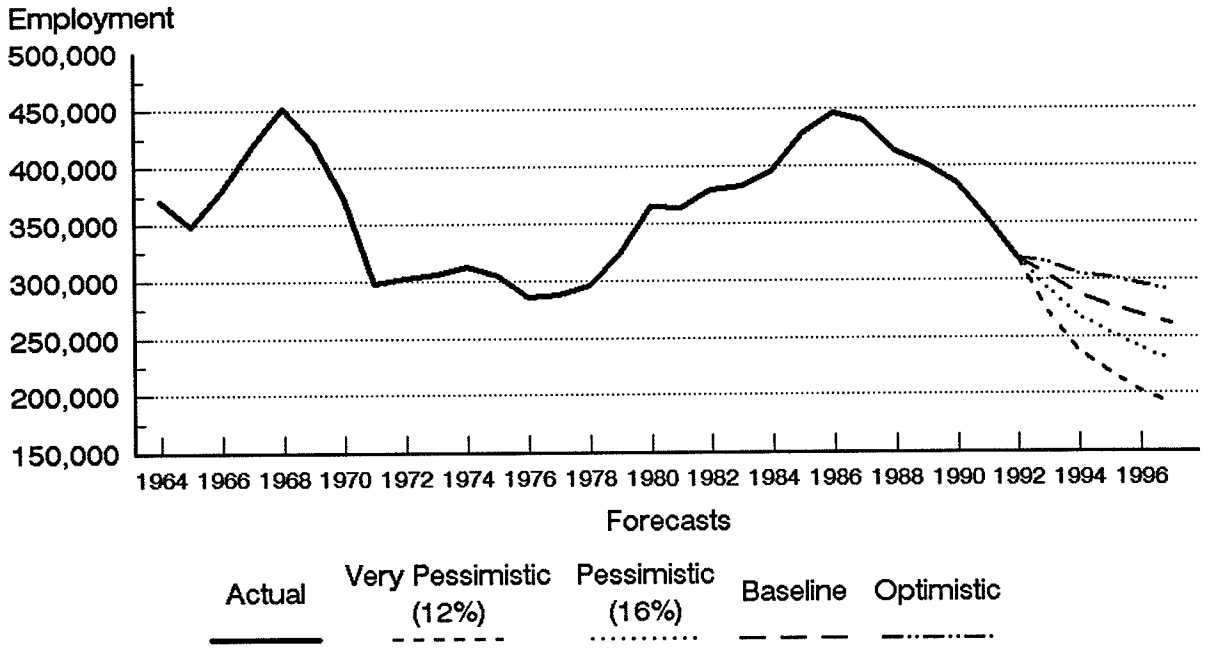
economy grows at a moderate pace beginning in 1994, and if the state continues to get at least 19 percent of the prime contracts awarded nationally, the model projects a loss of 24,000 more defense jobs from early 1993 levels, with defense manufacturing employment decreasing to just over 260,000 in 1997. Under more pessimistic assumptions, with the national economy growing slowly and California's share of defense spending dropping to 16 percent, the total predicted direct manufacturing job loss rises to about 55,000. In the unlikely circumstances that the national economy enters a period of strong growth and that California attracts a high proportion of total defense spending (22 percent), it is possible that defense sector employment will even increase from current levels. Even under these circumstances, defense manufacturing would remain below 300,000, with at least 120,000 fewer jobs than in 1988 (see Figure 4).

All of these forecasts are far less pessimistic than those released in the spring of 1993 by the California Commission on State Finance (COSF). The California Commission on State Finance estimates that an additional 90,000 jobs may be lost in defense manufacturing and 35,000 in DOD civilian employment by 1997. (Our forecasting model does not address changes in DOD civilian employment; the COSF forecast of these drops closely mirrors the Department of Defense estimates of job shifts related to the latest proposed base realignments).

Why does such a wide disparity exist between the COSF forecasts of aerospace job losses and the econometric model results on defense manufacturing employment? The assumptions behind the COSF forecasts differ significantly from those embedded in the econometric model.[16] COSF assumes that current decreases in jobs will mirror the reduction during the last cycle of defense cuts in the late 1960s. In the 1960s, however, defense employment experienced a particularly rapid buildup (apparently anticipating further growth,

Figure 4

California Defense Manufacturing Employment 1964-1997F



Source: County Business Patterns, CA EDD, and CREUE estimates.
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rather than cuts) and a subsequent sharp decline (see Figure 3). Thus, this method risks overestimating long term job losses.

The econometric model, in contrast, is based on long term historic patterns of adjustment. It assumes there exists a historically stable relationship between employment, contracts and economic growth, and that job losses will follow this relationship. This assumption misses the possiblity that the way defense spending and economic growth translate into jobs may have fundametally changed in recent years. Defense firms, for example, may be hiring fewer workers overall, or in California, per contract dollar. The econometric forecasts are also very sensitive to the share of future contracts awarded to California. If California should receive only 12 percent of the nationwide level of prime contracts, rather than the 16 percent or 19 percent share discussed above, then the COSF forecast becomes more comparable to the model results. A 12 percent share of contracts would drop average 1993 employment for the year to 272,000 and would lead to further job losses by 1997 of 80,000. Historically, California has captured between 17 and 23 percent of prime contracts. The prediction of losses in the range of 90,000 more jobs, then, appears to be a "worst case." While this could certainly occur, there nevertheless is hope that the continuing loss will in fact be much less severe.

Clearly, the long term future of employment in these sectors is uncertain. Over the next few years, defense employment will likely drop further, but by how much is still at issue. In the longer term, the structural characteristics of the industry will determine how different sectors will adjust to decreased demand generated by defense spending, the extent to which they will switch to new activities or markets, where job losses or job increases will occur within the state, and the types of jobs lost or generated. The following two sections describe first the geographic characteristics of defense sectors and then the structural characteristics

of defense manufacturing sectors that will affect how companies and regions adjust to changing spending levels.

The Geographic Spread of Defense Sector Impacts

The defense industry has not played an equal role throughout the state, either in existing economic activity or in its contribution to job losses. Defense manufacturing has been most heavily concentrated in Southern California and in Santa Clara County, while military bases have affected many other Northern and Central California counties.

Southern California has by far the greatest concentration of defense manufacturing jobs. Los Angeles County, with one third of the state's employment in 1988, had over half of all defense manufacturing jobs. The greater Los Angeles metropolitan area (including also Orange, Santa Barbara, Riverside/San Bernardino and Ventura), combined with San Diego County, accounted for over 80 percent of the state's defense manufacturing jobs by 1990 (see Table 6). Defense manufacturing, while a fairly small component directly of the total job base, dominates the manufacturing job base of many Southern California counties. It accounted for between 20 and 35 percent of all manufacturing employment in Los Angeles, Orange, San Diego, Santa Barbara and Ventura Counties in 1988, as shown in Figure 5. Aerospace firms dominate the defense sector in Southern California. Almost three-fifths of the state's employment in aircraft and parts and missiles and space manufacturing is in Los Angeles County, while the Southern California region accounts for over 85 percent of all employment in these two sectors combined. The Southern California region includes almost 90 percent of employment in search and navigation equipment, largely in Los Angeles and Orange counties (see Table 7).

In contrast, Northern California is far less dependent on defense manufacturing.

Table 6: Defense Manufacturing Employment by Metropolitan Area, 1988, 1990 and 1993

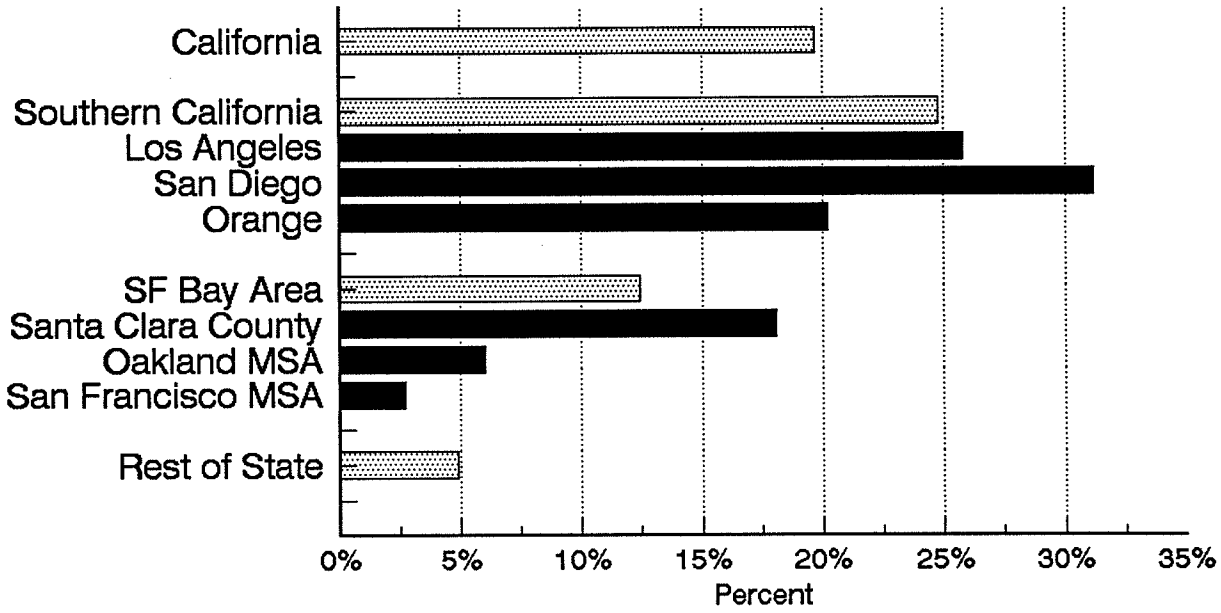
Metropolitan Area	1988	1990	1993	Share of State 1990	Share of State 1993	Change 1990-93	Share of Change 90-93	Percent Change 90-93
California	413100	385200	272000	100.0%	100.0%	-113200	100.00%	-29.4%
Southern California	345100	320700	219300	83.3%	80.6%	-101400	89.58%	-31.6%
Anaheim/Santa Ana	52200	45500	33900	11.8%	12.5%	-11600	10.25%	-25.5%
Los Angeles	227100	209400	135000	54.4%	49.6%	-74400	65.72%	-35.5%
Oxnard/Ventura	6900	6100	4100	1.6%	1.5%	-2000	1.77%	-32.8%
Riverside/San Bern	12200	11100	9200	2.9%	3.4%	-1900	1.68%	-17.1%
San Diego	40300	43000	32900	11.2%	12.1%	-10100	8.92%	-23.5%
Santa Barbara	6400	5600	4200	1.5%	1.5%	-1400	1.24%	-25.0%
San Francisco Bay Area	55800	53000	41300	13.8%	15.2%	-11700	10.34%	-22.1%
Oakland	2900	3100	2700	0.8%	1.0%	-400	0.35%	-12.9%
San Jose	50200	47700	36700	12.4%	13.5%	-11000	9.72%	-23.1%
San Francisco	2700	2200	1900	0.6%	0.7%	-300	0.27%	-13.6%
Rest of State	12200	11500	11400	3.0%	4.2%	-100	0.09%	-0.9%

Note: Southern California and Bay Area categories are totals only for the metropolitan areas listed in the table.

Source: CREUE estimates from Employment Development Department and County Business Patterns Data.

Figure 5

Share of Manufacturing Employment in Defense
Selected California Regions, 1988



Source: CREUE from EDD and County Business Patterns data.

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Table 7: Defense Sector Employment by Metropolitan Area
Percent of Statewide Sector Employment

Metropolitan Area	Communications Equipment	Aircraft and Missiles	Search & Nav. Equipment	Civilian DOD
Los Angeles	16.5%	58.5%	60.5%	9.8%
Orange	13.8%	8.6%	21.0%	3.1%
Other Southern California	15.9%	18.6%	7.4%	30.0%
Santa Clara	42.4%	11.0%	8.7%	1.2%
Other California	11.4%	3.3%	2.4%	55.9%

Source: CREUE estimates from Employment Development Department data, for 1988 (peak defense employment period).

Defense sectors accounted for 19.3 percent of all manufacturing jobs in Santa Clara County and for an estimated 15 percent of manufacturing jobs in Sacramento County in 1988. However, defense sectors accounted for less than 5 percent of manufacturing employment in the San Francisco and Oakland metropolitan areas (including Alameda and Contra Costa counties). The composition of defense manufacturing employment is also more diversified within Northern California. Communications equipment, for example, plays a substantially larger role in Northern California counties than in Southern California counties, while aerospace jobs are absent in many major Northern California counties.

The effects of direct spending on military bases in different regions of the state is far different from the impacts of defense contracts distributed to the private sector. Southern California had less than half of the state's civilian employment at military bases in 1988, compared to over 80 percent of contract-related defense manufacturing employment. Less than 10 percent of state civilian DOD jobs were in Los Angeles County (compared to over half of defense manufacturing jobs). Northern California counties with very small shares of defense manufacturing employment are much more significantly affected by DOD civilian jobs. Statewide, only one fourth of all defense related jobs (in the sectors of focus in this study) are civilian jobs for the military; the rest are private sector manufacturing jobs. In the San Francisco Bay Area, however, almost 40 percent of defense jobs are DOD civilian jobs. In the rest of northern and central California, DOD civilian jobs are over three fourths of total defense jobs.

Defense employment losses since 1990 have been particularly high in defense manufacturing as compared to DOD employment, with Southern California experiencing more than its share of manufacturing job losses. Since 1990, Los Angeles County alone has accounted for two thirds of the state's loss in defense manufacturing jobs (the county had

54.7 percent of the state's defense manufacturing jobs in 1990). Southern California as a whole accounted for 83.3 percent of the state's defense manufacturing employment but for 89.6 percent of job losses. DOD job losses, in contrast, have been much more serious outside of Southern California (see Table 8). DOD civilian employment dropped by only 7.1 percent between 1990 and 1993 in Southern California but by 19.5 percent in the San Francisco Bay Area. The Bay Area had 13.8 percent of defense manufacturing jobs in 1990 but experienced only 10.3 percent of manufacturing job losses in the state. In contrast, Bay Area counties had 24.7 percent of DOD civilian jobs but experienced 38.1 percent of job losses. The rest of Northern and Central California has also received a disproportionate share of losses. With 32.9 percent of base employment in 1990, the region experienced 38.1 percent of base-related job losses.

Further base related job losses are also expected to hit Northern and Central California more harshly than Southern California. As shown in Figure 6, jobs lost in DOD civilian employment through 1993 are only a small share of the total job loss expected from the three rounds of base realignment occurring between 1988 and 1993. Areas facing further job losses as a result of realignment are primarily in Northern and Central California.

As a result of these differences, the defense cut problem has been and will be experienced very differently in Northern and Southern California. Southern California has had a serious drop in several of its basic manufacturing sectors, while Northern California has been insulated from much of this loss, especially outside of Silicon Valley. In contrast, base closures are a much more serious concern outside of Southern California, and particularly outside of the Los Angeles, San Diego and Orange County metropolitan areas. These differing types of losses leave very different types of employees in search of new job opportunities, firms in search of new customers, and resources available for new economic activity.

Table 8: Civilian DOD Employment by Metropolitan Area, 1990 and 1993

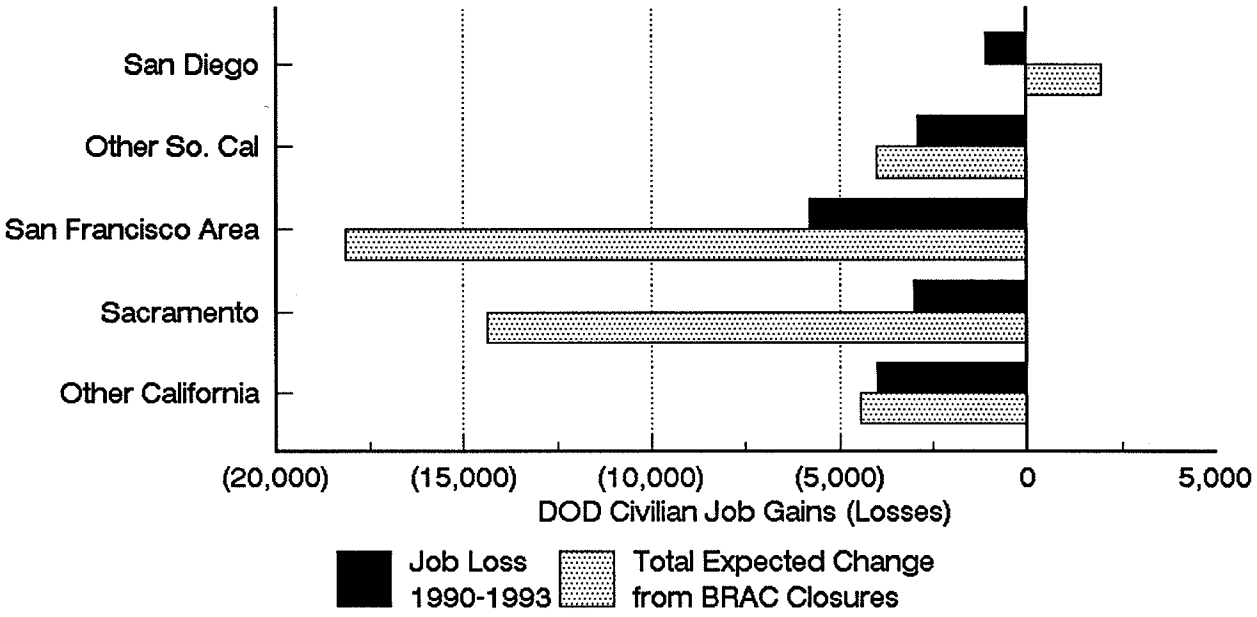
Metropolitan Area	March 1990	March 1993	Share of State 1990	Share of State 1993	Change 90-93	Share of Change 90-93	Percent Change March 90-93
California	133,300	116,500	100.0%	100.0%	-16800	100.0%	
Alameda/Contra Costa	12,400	11,800	9.3%	10.1%	-600	3.6%	-4.8%
Los Angeles	11,300	11,700	8.5%	10.0%	400	-2.4%	3.5%
Orange	4,100	2,900	3.1%	2.5%	-1200	7.1%	-29.3%
Sacramento MSA	16,600	13,600	12.5%	11.7%	-3000	17.9%	-18.1%
San Diego	23,600	22,500	17.7%	19.3%	-1100	6.5%	-4.7%
Santa Clara	1,600	1,000	1.2%	0.9%	-600	3.6%	-37.5%
Kern	8,600	8,400	6.5%	7.2%	-200	1.2%	-2.3%
Riverside/San Bernardino	8,500	6,500	6.4%	5.6%	-2000	11.9%	-23.5%
San Francisco MSA	7,300	4,900	5.5%	4.2%	-2400	14.3%	-32.9%
Solano/Napa	11,600	8,800	8.7%	7.6%	-2800	16.7%	-24.1%
Ventura	9,100	9,000	6.8%	7.7%	-100	0.6%	-1.1%
Southern California	56600	52600	42.5%	45.2%	-4000	23.8%	-7.1%
San Francisco Bay Area	32900	26500	24.7%	22.7%	-6400	38.1%	-19.5%
Rest of Northern and Central California	43800	37400	32.9%	32.1%	-6400	38.1%	-14.6%

Source: Bureau of Labor Statistics and California Employment Development Department.
Percentage calculations by Center for Real Estate and Urban Economics.

Figure 6

Recent and Expected DOD Civilian Job Loss/Gains

Selected California Areas



Source: CREUE from Bureau of Labor Statistics and California Comm. on State Finance data.

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Southern California has lost much of its top-end high-technology oriented manufacturing activity, while other parts of California have lost a broader, less specialized mix of jobs.

Structural Characteristics of Defense Firms

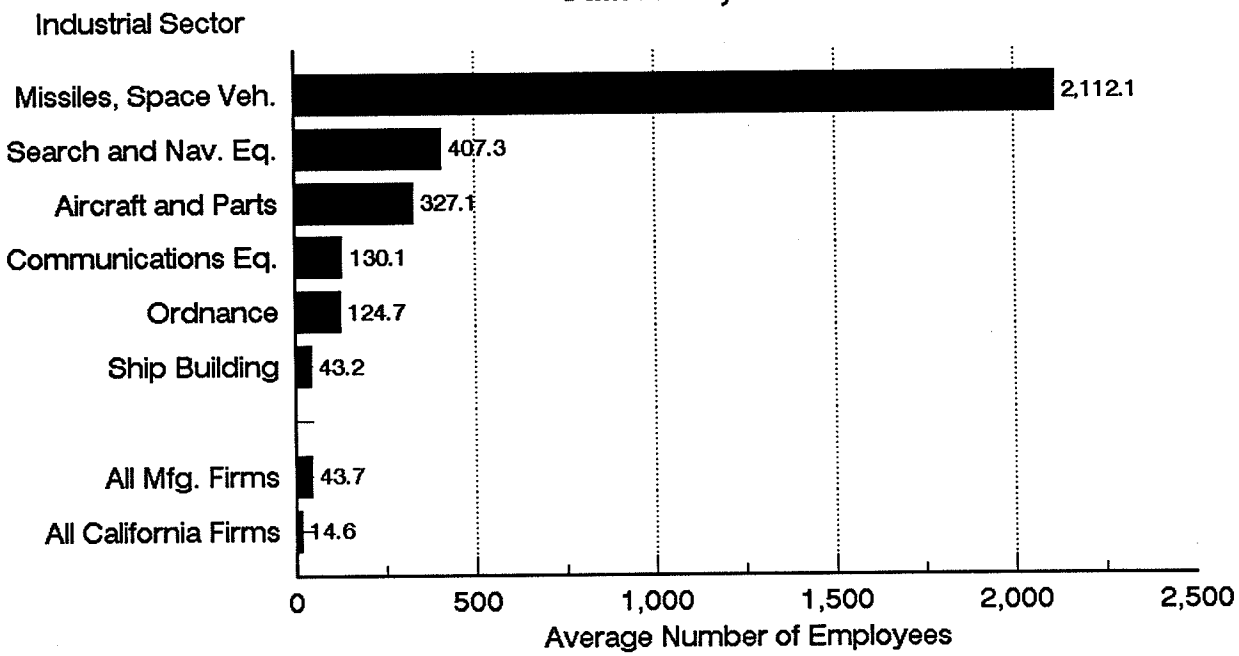
Geographers and economists analyzing the defense industry in the 1980s describe it as oligopolistic (dominated by a few large firms) and geographically concentrated.[17] The industry is dominated by one primary buyer, the DOD. Defense firms typically produce a limited number of expensive products, characterized by relatively low production volume and high engineering and development costs. Employees working in defense-oriented sectors are highly skilled and highly paid. Defense sectors are a major source of employment opportunities for a number of occupations. Markusen and Yudken, in their detailed study of the post cold-war economy, report that more than half of aircraft assemblers, more than one third of aero/astronautical engineers, and almost one fifth of tool programmers and electronic assemblers work in defense-related jobs.[18]

In California, defense manufacturing sectors are characterized, most broadly, by large firms employing a skilled workforce and paying high wages. In detail, there is a great deal of variation among sectors. At one extreme, the missiles and space vehicles sector has an average firm size of over 2000 employees (compared to an average statewide for all firms of 14.6 employees and for manufacturing firms of 43.7 employees) and a highly trained, well-paid labor force. Over 40 percent of employees are in professional and technical categories, and production worker wages are one third higher than the average for manufacturing. At the other extreme, ordnance and ship-building firms are far smaller (though ordnance firms are larger than the statewide average), have higher shares of production workers (66 to 86 percent), and wage levels much closer to the average for manufacturing. (See Figure 7 and

Figure 7

Average Firm Size, Defense Sectors

California, 1988



Source: CREUE from County Business Patterns.

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Tables 9 and 10).

Average firm size numbers do not fully indicate the degree of concentration of employment in large firms. In addition to missiles and space vehicles, employment in aircraft and parts and search and navigation equipment is also heavily concentrated in large firms. As shown in Figure 8, over four fifths of employment in aircraft and parts and search and navigation equipment is in firms with 500 or more employees, and virtually all of employment in missiles and space vehicles is in such firms.

The counties dependent on missiles and space vehicles, aircraft and parts and search and navigation equipment firms face a scenario shaped by larger firms, with highly skilled, well-paid workers. Simply because of their size, large companies are more likely to be involved in major layoffs when faced with revenue cuts. In addition, earlier research on the defense industry has suggested that the largest firms are often vertically integrated (doing many steps of the production process in-house), and lack flexibility in their production processes. They may have little experience in commercial production and also may be quite limited in their options for diversification. The jobs lost are among the best in manufacturing, with high salaries for professional, technical and production workers. In these sectors, firms historically have not switched easily to other products, and workers have often faced difficulties moving to comparable occupations.[19] The concentration of these firms in Southern California is a further troubling factor in the region's poor showing in the 1990-1992 nationwide recession and its failure to show signs of recovery by late 1993. Alternative industrial sectors showing relative strength in Southern California have either a much lower-skilled, lower paid occupational and wage profile (e.g. apparel) or use educated workers whose skills are not closely parallel to defense worker's skills (e.g. health, motion pictures).

In other defense sectors, communications equipment for example, smaller firm size and

Table 9: Occupational Mix in Defense Sectors and Other Selected Industries

Industrial Sector	Major Occupational Categories					
	Managers/ Adminis.	Prof'l/ Tech	Production	Clerical/ Support	Service	Other
Ordnance	8.2%	10.2%	66.4%	10.0%	1.6%	3.6%
Communications Equip.	12.4%	29.9%	34.7%	19.3%	0.8%	2.8%
Aircraft and Parts	7.3%	39.7%	37.3%	13.6%	1.8%	0.4%
Shipbuilding	4.4%	2.7%	86.0%	5.6%	1.0%	0.3%
Missiles and Space	7.7%	41.5%	36.6%	11.5%	2.7%	0.1%
Search and Navigation	12.5%	50.1%	21.6%	14.0%	1.7%	1.2%
Apparel, Textiles	3.9%	1.8%	79.8%	10.9%	1.1%	2.6%
Chemicals	10.4%	18.5%	42.3%	17.8%	1.9%	9.1%
Business Services	8.7%	22.0%	13.9%	30.6%	17.1%	7.8%
Motion Pictures	13.6%	28.2%	8.9%	24.1%	18.6%	6.6%
Health Services	4.1%	37.7%	2.3%	25.7%	29.6%	0.7%

Source: California Employment Development Department Occupation and Employment Survey, 1986 and 1991.
Rows may not add to 100% due to rounding of values.

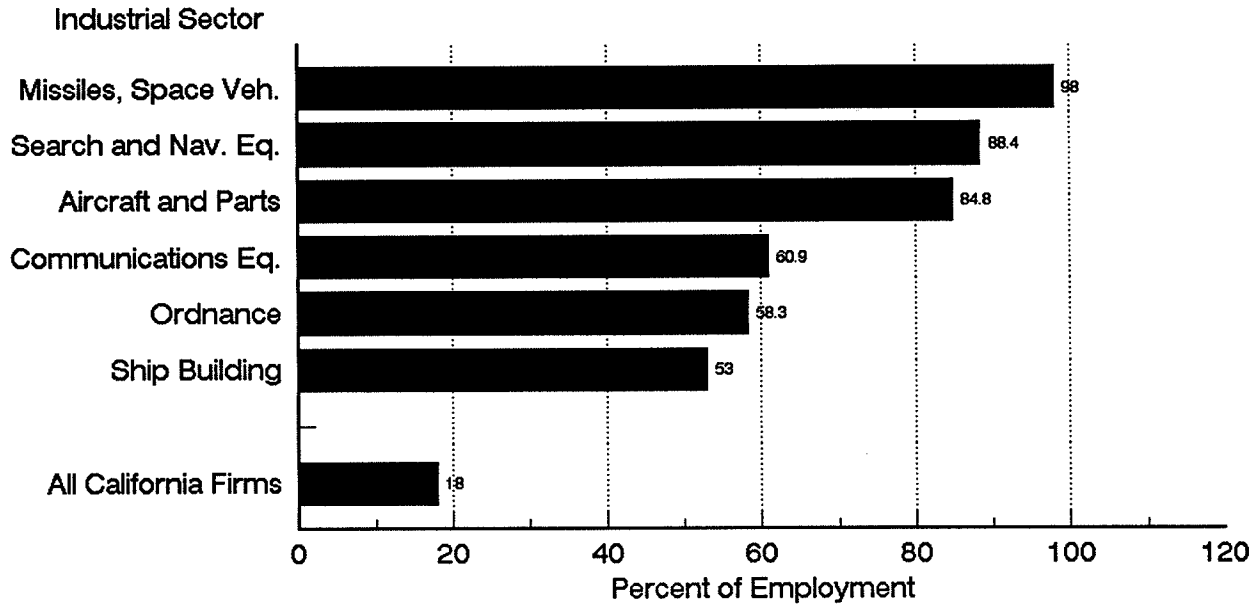
Table 10: Wages of Production and Nonsupervisory Workers
Defense and Other Comparative Sectors

Sector	Average Hourly Wage	Percent of Average Manufacturing Wage
All Private Nonfarm	$10.33	92.4%
All Manufacturing	$11.18	100.0%
Defense Sectors		
Ordnance	$12.32	110.2%
Communications Eq.	$11.47	102.6%
Aircraft and Parts	$15.61	139.6%
Missiles & Space Vehicles	$14.90	133.3%
Search & Navigation	$15.15	135.5%
Other Comparative Sectors		
Apparel	$6.77	60.6%
Chemicals	$14.02	125.4%
Health Care	$10.96	98.0%
Business Services	$9.75	87.2%
Motion Pictures	$11.80	105.5%
Computer, Data Processing	$15.57	139.3%

Source: U.S. Department of Labor, Employment and Earnings, August 1992.

Figure 8

Percent of Jobs in Firms with 500+ Employees
California Defense Sectors



Source: CREUE estimates using County Business Patterns and Cal. Dept. of Commerce data, 1988.
CREUE-Oct93 defwpf8

a more diverse employee base may leave the industry more flexible in adjusting to changing defense spending levels. To the extent that employees are not as highly paid, they may have greater options for finding comparable jobs in other manufacturing sectors. Also, because of firm structure and the type of product manufactured, firms in this sector may have greater options for switching to commercial products. The relative diversification of Northern California high tech industries, compared to the heavier concentration on defense in Southern California and particularly in Los Angeles County, helps to explain the greater resilience of the northern part of the state in the recent recession.

Even in Southern California or in the least adaptable segments of the industry, defense sectors have brought highly trained workers into California and have encouraged broad networks of support services that will become resources for further growth and new business development in the state. These resources may require directed action either within the firms or from outside organizations to redirect them towards alternative economic activities.

An Industry in the Midst of Change

What will be involved in California's recovery from the drop-off in defense activity? Over the next decade, the direction and composition of economic growth in California will depend upon 1) the ability of firms to shift production to nonmilitary products and customers; 2) the ability of California defense firms to maintain or expand their share of the shrinking defense budget; 3) the ability of defense employees to find alternative employment at comparable salary and benefit levels; 4) the extent to which local economies can shift from a dependence on defense firms or a military base to other basic economic activities; and 5) the degree and direction of support provided from the Federal and state levels. An understanding of these characteristics depends not only on the statistics presented above but

also on a clear picture of the alternative strategies likely to be undertaken by defense firms in responding to cuts and of government policy as it has shaped the defense industry and the recovery from defense cuts.

Conversion, Diversification and Other Alternatives

Much of the focus of early discussions on responding to defense cuts was on the concept of "conversion." In its narrowest sense, this refers to the reorientation within firms of defense dependent production to nondefense government and commercial markets. Research that first began addressing the defense cut impacts on the economy focussed particularly on this type of adjustment. A general conclusion of this research is that a much more diverse set of opportunities must be considered, not only by individual firms but also by workers and by communities.

The literature of the 1980s is quite pessimistic on the ability of firms to convert from defense production to alternative products. Markusen and Yudken, for example, note that "Military-industrial firms have developed a culture that is geared to the military market, and they find it hard to break out of its strictures."[20] Typical barriers to conversion noted in the literature include the long term nature of contracts (and the inexperience of firms in dealing with production requiring quick turn-around), the tendency of defense firms to produce to specifications rather than in a competitive market, expensive overhead resulting from inflexible and outdated equipment and small production runs, contract provisions that limit diffusion of innovations for national security reasons, geographic separation of defense firms from civilian businesses that might use similar equipment and construction strategies, and workforce characteristics (high salaries, specialized skills, experience in managing long term production rather than meeting deadlines in a competitive environment). Firms that have tried to convert

to other product lines despite these barriers have often been unsuccessful in entering new product markets and have tended to return to defense production when budget increases occurred once again. Markusen and Yudken note, "Contractors seem to believe that there are two lessons in the long history of defense busts and booms: efforts to pursue new products are doomed to failure, and defense will always come back to bail them out."[21] Where some measure of success has occurred, the conversion has rarely brought about a direct substitution of one activity or market for the defense-oriented one. Conversions do not necessarily involve the continued employment of defense workers and may even involve a physical move away from the community and older plant.

Recovery from defense cuts would involve much more than direct conversion of production at defense firms to nondefense items. Alternatives for firms are far wider than conversion alone, and for defense workers and defense based communities, recovery from defense cuts is likely to depend on more than the decisions taken by the impacted defense firms.

Alternative Approaches for the Firm

From a firm's perspective, response strategies include diversification, spinoff, divestment and warmdown in addition, or as alternatives, to conversion. These terms represent a wide range of choices. At one extreme, firms may divest themselves of defense-related production activities (for example, by selling the weapons producing arm of the corporation to another firm). At the opposite extreme, a firm may decide to "warmdown," or find niches within the defense budget that will allow the firm to continue to operate primarily as a defense contractor. Conversion, spinoff (producing consumer goods as well as defense-related goods that make use of the same technology), and diversification (e.g. by the acquisition of other types of production lines) are other survival strategies for defense

contractors. Examples of California firms adopting each of these strategies are discussed somewhat later in this paper. A general characteristic of all of these firm strategies are that they are designed with the future of the firm, rather than the labor force or community, in mind.

Approaches for Workers and Communities

The successful conversion, diversification, or warmdown of a firm does not necessarily mean that jobs will be preserved, especially locally. In addition, where the defense cut is in the form of a base closure, the employer (DOD) is unlikely to be directly involved in conversion efforts for the facility, beyond the early planning stages.

Successful transition for defense workers involves more than firm decisions. The firm can ease the transition by preserving as much of the production activity as possible or by diversifying into areas with similar labor force requirements in terms of skill level and production levels. Most defense firms are unable to create this level of support, leaving displaced defense workers dependent on a limited set of alternatives, including 1) finding comparable employment in a different local firm, 2) retraining for other occupations, 3) accepting lower wage employment in another industry, 4) moving to another geographic area in search of comparable employment, or 5) starting a new business. Replacing income-earning activities at a comparable level of income has been the most difficult goal to achieve in any of these transition choices.

Even a successful recovery effort by a firm will not necessarily help a defense-related community if the recovery involves reduced employment levels (either through cutbacks or moves) in the local area. In the case of base realignments "recovery efforts" most likely will not include preserving the base for a military activity (except for areas such as San Diego receiving the realigned forces). The job-producing defense activity instead would be

completely removed from the community.

Many of the terms applied to firms are appropriate for discussing community choices as well. Historically, communities in recovering from a plant closure or the decline of a key industry have looked for opportunities to 1) compete successfully for the remaining industrial activity of the type being lost, 2) encourage the development of related activities that would use existing physical or human capital, and/or 3) diversify into other areas of industrial activity.

California Players in Recovery

Recovery from defense cuts, then, will involved decisions of firms, of government officials, of community organizations, and of individual workers. Actions may be taken alone or by two or more entities acting together. Many of the actions are in experimental stages, with their degree of success as yet unknown. The following sections highlight some of the key directions being followed by firms, consortiums, public-private joint ventures, or local government committees, to move towards growth.

Restructuring of California Defense Firms

While the barriers to conversion described earlier are real and troubling, they do not suggest that firms are unable to recover from defense cuts. Indeed, California firms have been experimenting with different types of responses for more than half a decade. The types of responses chosen reflect a variety of firm characteristics ranging from firm size to the defense product line of the firm.

Divestment, Consolidation and Warmdown--The Extremes

For diversified firms with successful commercial as well as defense production lines, the cutback in defense spending may become the impetus to leave this market area to others.

General Dynamics, for example, has divested itself of its defense lines of production, selling them to Lockheed Aerospace and Hughes Aircraft. The firm did not attempt to maintain its employee base in defense, but instead has concentrated on other growing segments of its product base. Lockheed, in contrast, has used this period as an opportunity to increase its domination of the industry by gaining a greater market share within defense production, by diversifying its defense product lines.

Some smaller firms have chosen to remain primarily defense firms, rather than converting or diversifying into commercial areas of production. This process of "warmdown" may require that they continue to produce existing products but rely more on research and development and less on production while waiting out the period of defense cuts. This strategy implies the expectation either that the firm can survive successfully in the long term with a smaller level of production or that defense spending will once again increase after a period of time. The approach is particularly well suited to firms in defense product lines that are not being heavily cut. Condor Systems, for example, in Silicon Valley, a designer and producer of surveillance equipment, sees long term opportunities in this product area despite overall defense cuts.

Conversion, Diversification, and Spinoffs

Between divestment and warmdown, firms are experimenting with a number of different strategies, including product line conversion, diversification, spin-off and dual-use technology. Product line conversion involves the reorientation of some product lines to commercial production of alternative products. Aerojet, a California based prime defense contractor with businesses in propulsion, electronic systems, and ordnance, has recently developed a division for new non-defense technologies in areas such as environmental resource recovery, transportation safety, and energy management. Diversification includes

the acquisition and consolidation by defense contractors of other defense firms or of civilian-oriented production lines, as with the Lockheed and Hughes examples already cited.

The spin-off strategy involves the application of existing technologies tailored for military-oriented production of goods in production for commercial markets. Lockheed has developed non-defense products for public agencies. These include technology services such as remote bar coding services for the U.S. Postal Service, automated toll road collection programs, and child support and parking ticket collection services. Trimble Navigation, whose geographic positioning system (GPS) was used in 1991-1992 Desert Shield and Desert Storm activities, is producing navigational instruments for commercial use. Simultaneously employing the existing technology for military and commercial-oriented production is referred to as the utilization of "dual-use technologies" and has been promoted by the Defense Advanced Research Projects Agency (formerly DARPA and now ARPA). Most common dual-use fields include opto-electronics, ceramic fibers and superconductivity.

Employment Implications of Firm Strategies

While the response strategies within firms offer exciting long term opportunities for the state's economy, they are unlikely to be significant job producers in the near future. Indeed, many of the strategies involve employment consolidation rather than expansion. In the case of Hughes, for example, although the firm has been diversifying for several years, its approach to its California operations has been primarily one of job consolidation, with the great portion of remaining jobs relocating out of state. Lockheed, in spite of expansion and diversification of product lines, has reduced its employee base from a peak of 48,000 in 1985 to about 28,000 workers in 1993.

Combining Resources through Joint Ventures

In the cases just described, the firms have each made individual decisions regarding responses to defense cut-backs. However, many of the decisions now being made, sometimes with the help of Federal incentives, involve more than one player. A number of different cooperative efforts, or joint ventures, have begun in California, with the hopes of making the companies and regions involved more competitive as the economy adjusts to defense cuts. These may involve partnerships among many companies pursuing long term development goals, partnerships among a few firms pursuing the development of a specific product, long range community/company planning and development efforts, and public/private efforts designed specifically to address worker retraining issues. In some cases, the efforts may support and strengthen existing geographic nodes of expertise, as with Joint Venture: Silicon Valley (JVSV); in other cases, the efforts may support the creation of new nodes, as with the CALSTART effort.

Developing New Nodes of Expertise (e.g. CALSTART)

One ambitious recovery effort combines the expertise of California defense contractors with Federal funding for the development of zero-emission vehicles to create a new, advanced transportation technology industry in California. CALSTART is a statewide advanced transportation consortium, one of three established by a $10 million appropriation through the Inter-modal Surface Transportation Efficiency Act of 1991 (ISTEA). California was well suited as a location for this venture because, in order to meet Federal EPA standards, the California Air Resource Board has mandated that 2 percent of all cars sold in California be zero-emission vehicles by 1998, with the ratio rising to 10 percent by 2003. Research on the electric vehicle manufacturing industry in California has found that the state breeds technological innovation and possesses a broad industrial and manufacturing base capable of developing and

manufacturing electric vehicles.[22] Los Angeles is already a design center for automobile manufacturers worldwide.

The founding concept for CALSTART is attributable to Dr. Lon Bell, President of Amerigon Incorporated, an aerospace engineer already experienced with converting defense ideas to commercial uses. (For example, he used missile re-entry technology to develop the automobile air bag impact device). CALSTART has strong participation by defense contractors and several utility companies, as well as support from other California businesses, local and Federal transportation agencies, a labor group and an environmental organization.

CALSTART received $4 million in Federal funding through ISTEA, about $2 million in state funding, and has raised $14 million from its members. A goal of the electric vehicle program of CALSTART is not only the design and engineering of environmentally clean transportation but the creation of 55,000 jobs in California. CALSTART also intends to facilitate innovation and design of related technologies by providing a "project hatchery" servicing firms and designers with a technology advisory board. The board, made up of scientists and engineers from universities and the private sector, will act as an initial screening and advisory group reviewing proposals to Federal agencies for joint venture and technology transfer projects.

New Directions from Existing Nodes (e.g. Joint Venture: Silicon Valley)

While one of CALSTART's goals is the fostering of a new node for an emerging technology, other programs are directed toward strengthening existing economic nodes. Joint Venture: Silicon Valley (JVSV) was created in January 1992 by a group of Silicon Valley industry, government, community, and education leaders, to promote the transition and continuing competitiveness of the region's firms and workforce. The mission of the consortium has been to develop both industry strategy and public policy recommendations for

business issues unique to the Silicon Valley. A number of initiatives have grown out of the JVSV process. Some are focussed on improving the business climate while others address issues related to the region's transforming and emerging industry clusters. One of the key initiatives created is the Defense/Space Consortium, a grouping of defense, space and commercial firms, education and research organizations, and local and state public entities. The consortium is organized to foster technology partnerships. Goals are to maintain a defense base in the region but also to seek both public and private grants to provide the start-up infrastructure and technical support for businesses interested in collaborative efforts using new technologies. The Defense/Space consortium is also active in organizing and supporting a region-wide defense workforce retraining and job placement effort.

Joint Planning for Worker Retraining (e.g. San Diego Economic Adjustment Program)

While the joint ventures described above focus on the needs of firms and broad goals of new business creation, the retraining and placement of displaced workers also benefits from cooperative activities among firms and public agencies. A good example is the effort by the San Diego Private Industry Council (PIC), a business consortium, to plan for a systematic adjustment to the impacts of defense cuts on contractors and their employees. With a grant from the DOD Office of Economic Adjustment and the California Trade and Commerce Agency, the PIC undertook a study of San Diego's economy focussing on defense-oriented firms. One of the study's goals was to identify the growing industries and technologies for the purpose of guiding retraining efforts to match those industries. The growing industries in the San Diego region include computers (hardware components and software), communications (telecommunications, business and trade systems), digital imagining (digital compression, high defnition TV (HDTV), precision instruments (electro-mechanical and electronic), health (biomedical and biotechnology fields), entertainment and

information (broadcast and cable technologies), business services (environmental services and products), and consumer durables, (particularly transport technologies).

The consortium estimates total worker displacement during the period of 1991 through 1993 to exceed 28,000, (which includes 10,000 jobs in 1993 alone). Several worker retraining programs have been set up with funding through the Job Training and Partnership Act and other Department of Labor funding. Likewise, businesses seeking guidance on developing new uses for technology are linked to such groups as University of California San Diego's CONNECT program. CONNECT provides industry advisory services for new technology, then links firms with partners and venture capital.

Private Joint Venture Projects for Specific Products

Some firms have acted cooperatively privately, without forming public/private partnerships. In some cases, firms are organizing new partnerships as a way of maintaining their industry hold. For example, two leading manufacturers of military vehicles--FMC Corporation of Chicago, a mining, machinery and chemicals conglomerate that has its military systems group based in Santa Clara, and Harsco Corporation of Pennsylvania--have agreed to combine their operations in a joint venture to be controlled by FMC.

In other cases, diversification beyond defense is the purpose of the partnership. Aerojet, an aerospace and defense contractor, has joined with Pacific Gas & Electric, a Northern California utilities company, to adapt military and space technology to produce a low cost, lightweight mobile natural gas storage unit that can be useful for companies operating fleets of vehicles. Natural gas is a near zero emission fuel. Vehicles using natural gas are currently being factory produced, but the natural gas distribution system for vehicles is limited. Aerojet is using technology similar to that used on propulsion systems for the Polaris and Peacekeeper missiles and in SDI programs. The mobile storage module will carry one and

a half times the volume of natural gas, and is one third the weight of a standard steel module on the road today. Due to the lightweight composite material of the new tanks, trucks will now be able to use roads with weight limits, thereby expanding the market of this cleaner fuel. The partners, both on CALSTART's Board of Directors, have sought ARPA funding for this project through the Technology Reinvestment Program.

Aerojet has also joined forces with TRW Aerospace and Siemens Duewag Corporation, a supplier of light-rail vehicles, to build 72 rail cars for the Green Line rund by the Los Angeles transit authority. In all, five of the nation's largest military and aerospace contractors bid for the $200 million dollar contract, which was awarded to Siemens in August 1993. The contract also includes a $10 million "incentive" aimed at the military contractors to develop advanced transportaton products that may be used on other transit projects.

Trimble Navigation (creator of GPS) is forming joint ventures with Westinghouse Electric Corporation and other communications firms to develop and implement vehicle tracking systems for public service vehicles such as ambulances, police and fire vehicles as well as public transportation vehicles. In a commercial space/communications application, Motorola has contracted with Lockheed Missiles & Space Company to build 125 spacecraft buses for the Iridium low-Earth orbit mobile communications system. The contract is valued at more than $700 million. Iridium, a commercial enterprise, has been described as the most capable and expensive of several low-Earth orbit telecommunications proposals. The network is designed to permit any type of telephone transmission--voice, data, fax, paging--between any two points on Earth at any time. Lockheed describes this project as a significant step toward diversification and an important example of the transfer of defense technologies into the commercial arena.

The Long Term Nature of Recovery

All of these efforts are important to California's economic recovery. However, they are unlikely to quickly replace the jobs lost over the past half decade. Many of the programs involve efforts with long term goals; significant job growth from these efforts may not occur for five years, ten years or longer. Base closure recovery efforts, described in the following section, are also likely to be long term in their impacts.

Recovery from Base Closures

Recovery from base closures and realignments presents a different situation from recovery from prime contract cuts. With the DOD leaving an area, no organizational structure equivalent to a firm remains to plan for future economic expansion and alternative employment opportunities for displaced workers. The civilian employees laid off when base closure occurs are also likely to have quite different skills from those leaving a position with a defense contractor. In the absence of a direct role for private firms in base closures, the Federal government has taken an active role at the early stages of base closure, passing responsibility as quickly as possible on to local government and community organizations.

During the 1950s and 1960s, the decision to close or realign a base was left solely to the President, in his role as Commander in Chief, and acting through the Secretary of Defense. Bases could be closed with little warning, and federal policy allowed for closed bases to be sold to local municipalities for as little as $1, without consideration to issues such as environmental contamination. The National Environmental Policy Act (NEPA) brought the first level of broader review to DOD decisions on base closure. Then, in 1977, President Ford signed legislation giving Congress the right to approve or disapprove all base closures and major realighnments. This act was followed by a period of very few base realignments. With

changing military priorities in the late 1980s, the Military Base Closure and Realignment Commission (BRAC) was formed to review intent and costs of U.S. military bases through the world with the intention of reducing both forces and bases. Three rounds of BRAC closures, in 1988, 1991 and 1993, have left over twenty California bases closed or planned for closure (see Appendix B).

Reuse priorities, as established by legislation and by DOD policy, are: 1) Other DOD uses, 2) other federal agencies, 3) homeless housing (required by the McKinley Act of 1987), 4) state and local agencies, and 5) public sale. In most cases, once the decision has been made against reuse of the facility by a Federal agency, local authorities have the responsibility to coordinate reuse planning. DOD's Office of Economic Adjustment provides grants to local authorities for reuse/conversion planning, while the Department of Commerce Economic Development Administration provides grants to implement plans. A number of California communities have received OEA grants but none have yet received EDA grants.

Early base closure experience in California was not promising. In the San Francisco Bay Area, early closures of Hamilton Airforce Base and the Hunter's Point Shipyards occurred after NEPA was passed but before the 1977 Act. A combination of toxic waste problems and community disagreements have kept either base from transferring successfully into some type of civilian use. Some bases involved in the 1988 round of BRAC closures also became the focus of divisive local power struggles. In contrast, the San Francisco Presidio, also on the 1988 BRAC list but already pledged to the Department of Interior (DOI), Golden Gate Recreation Area, has experienced a much smoother transition, with cooperation between the DOI and the City of San Francisco in the reuse planning efforts. The base is being converted to recreational use primarily, with some sites devoted to small business development.

More broadly, it appears that planning efforts have been successful where transfer has

been to another Federal agency (as with the San Francisco Presidio or the takeover by NASA of Moffett Field), where there has been a clear "best use" for the facility (as with the proposed a civilian airfield at Castle AFB), where community groups have focussed on identifying a new use rather than fighting closure (the strategy that led to a proposed state university branch at Fort Ord), and where there has been clear information from the DOD on their planned level of presence in the future and the timing of cuts or closures.[23]

In the long term, the future levels of reuse at California military bases is as uncertain as the rate at which defense jobs will drop or the economy as a whole will recover. The range of industrial opportunities and job levels likely to be generated as bases are reused is very broad. Successful reuse of bases, like diversification efforts of firms, is not judged solely by job generation. Base land may be used to meet other needs as well, from housing to recreation. To the extent that it is used for job development, a strong planning effort can set the stage for new growth of diverse economic activities.

The Federal Role in Recovery

DOD spending has been one of the nation's strongest industrial development policy tools in the 20th century (although not explicitly designed for this purpose). Defense spending decisions have affected industrial growth and innovation through directions of R&D spending, through characteristics of military procurement, and through limitations and restrictions set on products produced with defense dollars. Defense has accounted for a large share of Federal R&D spending, especially since the 1980s. Researchers such as Markusen (1985) and Goldstein (1991) argue that this has drawn resources away from commercially oriented sectors and has often channeled resources towards large firms and away from smaller firms.[24] The Federal role in recovery most likely will be somewhat smaller than in the build-

up, if only because the dollars spent are fewer. However, the direction chosen for spending can be very influential in the types of activities undertaken by firms and communities.

New directions in defense spending have already shifted more than once since the late 1980s and the end of the cold war. Bush administration policy in the late 1980s focussed primarily on cushioning the blow to firms, workers and communities. Congressional acts and Clinton Administration proposals expand on this approach, providing resources to expand into new technologically advanced economic endeavors.

Federal spending for adjustment has evolved towards meeting several goals. First, while the need for cuts are recognized, defense policy seeks to preserve a base level of defense production capability in the event of future needs and to maintain research and development for shifting military needs. Through careful management of procurement and by encouraging contractors to expand into civilian markets, the Defense Department seeks to ensure for contractors a base level of financial security necessary to keep firms intact and ready to meet sudden military needs.

Second, some programs are oriented toward taking advantage of defense-related R&D to improve innovation and competitiveness of U.S. manufacturing firms. National labs, such as Lawrence Livermore Lab and Sandia, both in Alameda County, for close to two decades have seen a portion of their defense-related Department of Energy funding replaced by funds encouraging research on energy resources, environmental issues, communications technology, and technology transfer from defense to commercial uses. Since 1987, Cooperative Research and Development Agreements (CRADAs) have been used to encourage commercial firms to work jointly with the national labs to develop new products or improve existing products. In addition to CRADAs, most of which are with large, national firms, the California labs also have local assistance programs where they help smaller businesses address technical design or

production problems.

Third, additional Federal appropriations are being specifically targeted at firms and communities impacted by defense cuts. The spring 1993 Clinton administration proposal would allocate 1.6 billion dollars in 1993 and perhaps as much as 19.6 billion over a 5-year period (1993 to 1997) for the broad purpose of mitigating the economic damage resulting from defense cuts (see Table 11). In the first year, over half would be directed specifically at defense contractors and the development of dual-use technologies, more than one fourth would be allocated to worker retraining, and the remainder would be targetted to community assistance and to new Federal high technology investments. In later years, close to half of the funding may shift to high technology initiatives, including CRADAs and numerous proposals to expand national information networks.

Fourth, some of the dollars cut from the defense budget have been redirected to nondefense efforts towards economic expansion. One of the largest non-DOD proposals was the Federal Highway Administration's ISTEA (mentioned earlier in regard to CALSTART). This Act appropriates $659 million dollars over a six year period for research and development on "intelligent vehicle-highway systems." The bill grants leeway on spending at the state and local levels and boosts financial support for a broad range of transportation and infrastructure projects, as well as anti-air pollution and decongestion programs. It also provides funds for research and development in the fields of magnetic levitation and intelligent vehicle highway systems.

California's share of defense recovery funds, if based on historic spending levels and level of impact, could be close to 20 percent of the proposed budget, but there will be an inevitable delay between appropriation and spending of the money. If defense recovery programs are fully funded, this would mean about $323 million in 1993 and perhaps on the

Table 11: Proposed Federal Appropriations for Conversion Programs March 1993 (Millions of Dollars)

Program	FY 93	Total FY 93-97
Community Assistance	$125	$1,223
Worker Retraining and Assistance	$462	$4,000
DOD Dual Use Technology Initiatives	$845	$4,701
New Federal High-Technology Investments	$185	$9,651
Total	$1,617	$19,575

Source: White House Office of Economic Policy.

order of $3.5 billion over the five-year period. In contrast, in 1992, the state received $23.8 billion in contracts, down $14.0 billion (in 1992 dollars) from the peak contract levels for the state in 1984. COSF projects that total defense spending in California, including spending related to military bases as well as prime contracts will drop from an estimated $51 billion in 1992 to $32 billion in 1997 (in constant 1992 dollars). Mitigation spending, clearly, is far below the amount being cut from the defense budget.

Despite the small proportion of funds lost represented by Federal spending, Federal dollars appear to be quite influential in shaping the direction of defense recovery efforts. Many of the programs for individual companies or joint ventures are already reliant on Federal assistance or are being shaped to help the firms or consortia compete for Federal funding.

An Emerging State Role

While the proposed Federal programs will certainly help in the state's recovery efforts, the degree to which growth and diversification out of the defense industry will occur also will depend on California's policy towards defense conversion as well as its use of existing and changing resources. Three types of factors will influence the state's direction and level of recovery. First are state level programs dealing directly with defense recovery for firms, workers or communities. Second are the broader strategies and investments the state is using now or has used in the past to influence economic growth. Third, current economic conditions are producing some changes (positive or negative) in the general business climate that may affect future growth.

State Programs for Defense Recovery[25]

The state of California has begun a number of activities directly aimed at dealing with the economy's recovery from defense cuts. State programs are designed both to direct state

resources to the regions or industrial sectors where they will be most effective and to aid in the distribution of Federal recovery funds to companies, communities, and workers within the state. The state's Trade and Commerce Agency has taken a lead in defense recovery programs for the state, with several different programs. The California Council on Defense Industry and Conversion, established by Governor Wilson earlier this year and chaired by the Secretary of Trade and Commerce, has the responsibilities of recommending state strategies, overseeing and coordinating state programs, and providing assistance to local level recovery programs. The council has committed $61.7 million in matching funds for the current year that can be applied to approved ARPA projects. The Trade and Commerce Agency also assists defense related economic development activities through its Office of Competitive Technology, which provides information on technology transfer funding mechanisms for businesses and academics engaged in defense technology spinoffs or the commercialization of environmental technology. The proposed Strategic Technologies program would allocate up to $8.2 million for matching funds for dual use and defense technology projects, for base reuse programs, and for a state economic development strategy. The Trade and Commerce Agency also has an Environmental Assistance/Defense Conversion program which offers "ombudsman" assistance to business for environmental, toxic waste and air quality related problems.

Several other state agencies are also involved in programs closely linked to defense recovery needs. The California Military Base Reuse Task Force, with staff assistance from the Governor's Office of Planning and Research, addresses the issues surrounding conversion of decommissioned military bases and other defense facilities to civilian use. The Office of Planning and Research also is responsible for coordinating base closure efforts among different parts of the state and with Federal agencies.

Environmental issues raised by base reuse are addressed by the Office of Environmental Health Hazards, which oversees remediation of toxic contaminants at military bases. Several state agencies are involved in various advanced transportation projects, including the Air Resources Board, through its Electric Car Program, the Department of Transportation, through its High Speed Train Program, and the Council on Science and Technology, through Project California, which, with a budget of $2.1 million for FY 93-94, supports advanced transportation projects using a mixture of public and private funds. The University of California, the California State University and the California Community College systems have developed information dissemination and technical assistance services for ARPA grant proposers.

Worker retraining needs are addressed by the Employment Development Department, through its Dislocated Workers Program (a program established under Title III of the Job Training Partnership Act). In addition, grants from EDD's Employment Training Panel can be used as state matches for Federal defense conversion technology programs.

Research support for state planning efforts has also been provided by the recently established California Research Bureau. As part of the state library, the bureau has prepared detailed reports on economic development programs in the state (including defense recovery efforts) and on base closures, as well as providing responses to briefer information requests from various state agencies.

State Policies and Programs Beyond Defense Recovery

The state has a range of programs broadly designed to address California's economic development needs. While not specifically defense oriented, many of these are relevant to recovery efforts. Several of these foster new technology development. The Energy Commission's Energy Technologies Advancement Program, for example, provides loans for

projects that make existing technologies more efficient or that develop alternative technologies to fossil fuels. The California Environmental Technology Partnership, established this year, promotes and assists the development, manufacture and export of California-based environmental technologies. The University of California and California State University systems also have numerous research programs related to technology development. Two other major directions for state economic development programs, business retention and export programs, also are of significance for defense recovery efforts.

Beyond programs specifically designed for economic development, other types of state policies and programs are credited with influencing business growth in the past and will continue to affect growth in the future. The strength of the high-tech industry in California, for example, is a result not only of defense related investments but also of the presence of a first-class public college and university system. California's position as a center for trade and distribution related to exports results not only from the state's geographic location but also from the major public infrastructure investments by state and local government that occurred over decades. These strengths now interact with emerging weaknesses in the state--a challenged primary and secondary education system, state spending cuts (especially in higher education and also in many areas of infrastructure investment and maintenance), and a growing undereducated segment of the labor force--and with long term controversies, such as tight environmental and building controls and the troubled worker's compensation system. How the state handles this diversity of programs is likely to be at least as influential in supporting or delaying growth as the funding specifically for defense recovery.

Recent activity in the summer and fall of 1993 suggests that the governor and state legislature are taking up the challenge with significant results. Reforms have been initiated in workers compensation coverage, the unitary tax law, and various investment credits, all

of which are expected to benefit businesses operating in California. The state's workers' compensation system has been reformed to provide lower costs to employers and raise compensation levels for covered workers, while limiting medical costs and tightening standards for claims in controversial areas such as stress. Other recently passed or proposed legislative changes include an investment tax credit, with special provisions for small and start-up businesses, elimination of a sunset provision on an existing research and development tax credit, and revisions to the method of income apportionment for the unitary tax, which affects multinational firms doing business in California.

Economic Conditions and the Business Climate

The strengths that have contributed to business growth in the past--a skilled labor force, mild climate, growing population base, first class universities, and geographic and cultural linkages to the Pacific Rim--are important components in the ability of firms and communities to generate new jobs and income to replace losses in the defense sector. Some of the consequences of the recession also will improve the state's competitive position, including a lower wage structure, an easing of the shortage of engineers and other skilled workers, and lower housing prices. These factors alone, however, cannot spur recovery from the decline of the defense industry. A major challenge to the state will be not only to attract new private and Federal investment into a program of restructuring away from defense sectors but also to use existing advantages to encourage restructured firms and activities, both in defense and in other sectors, to maintain a presence in the state. This involves, among other things, careful attention to long term issues such as environment protection and quality of education, which are central to the higher end industries in California's future.

The Bottom Line--How Fast Will Recovery Occur?

Of the two scenarios posited at the outset of this piece, which is more likely to occur? Our research shows that defense manufacturing growth helped to stem the loss of manufacturing jobs in the 1980s, while defense cuts have played a very significant role in the severity of the state's recession of the 1990s. The downsizing of this sector will certainly affect the economy's rate of growth. Some other economic sectors, such as construction employment, are also unlikely to recover quickly. The state budget problems will be a further drag on economic growth. Recovery will be impeded if a tight budget continues to mean an eroding of higher education systems, shortfalls for local governments and school districts, and little investment in infrastructure.

However, California job growth was based on a diversity of sectors in the 1980s, not only on defense related expansion or construction. There is no reason to expect that other sectors will be unable to grow in the 1990s. Indeed, the results of our forecasting model suggest that even defense-oriented manufacturing sectors may receive some cushioning from a stronger national economy. In addition, the state continues to offer fertile ground for new industry development. From skilled engineers seeking new occupations to expanding design centers for industries as diverse as apparel and automobiles, California has offered a climate conducive to new product and new market development. If a portion of defense cuts translate into Federal spending and private investment in new industrial development, California is well positioned to benefit from this shift.

Nevertheless, the transition is likely to be rough. The economy that emerges from the defense cut period and the 1990-92 recession will look significantly different than the economy of the late 1980s. Manufacturing will have taken a further step backwards as a key employment base in the state, with emerging manufacturing industries being small job

producers in their early stages. The most rapid manufacturing growth in the 1990s is likely to be in lower tech industries such as apparel, which make use of the expanding immigrant labor force, although growth of this type is unlikely to eclipse high tech as the mainstay of the state's manufacturing base. Additional employment growth is likely to occur primarily in nonmanufacturing sectors ranging from tourism to trade to business services and engineering and management services. Overall, growth is likely to remain slower in the nineties than in the eighties; this is only partly due to economic changes but also reflects demographic factors leading to the slowdown in growth of the labor force.

Footnotes

1. Center for the Continuing Study of the California Economy, California Economic Growth, 1993 Edition, Palo Alto, 1993.

2. The prime contract awards to California are reported by the Department of Defense in an annual report, Prime Contracts by State. Total defense spending is tabulated by the Commission on State Finance (COSF). The COSF numbers include three sources of spending not included in the Department of Defense numbers. These are defense-related NASA contracts, military base personnel, and classified research and procurement contracts.

3. These figures are cited in two California Commission on State Finance publications, The Impacts of Federal Expenditures on California, 1986, and The Impact of Defense Cuts on California, 1992.

4. California Commission on State Finance, Impacts of Defense Cuts on California, Sacramento, California, Fall 1992, Appendix A-3, p. 43.

5. See, for example, O'hUallachain, "Regional and Technological Implications of the Recent Growth in American Defense Spending," Annals of the Association of American Geographers, 72:208-23, 1987, for a discussion of the share of shipments to DOD. Some defense dollars come from agencies other than the DOD. For example, a portion of the Department of Energy budget is reserved for weapons research and development (largely nuclear).

6. SIC stands for Standard Industrial Classification code, a set of definitions maintained by the U.S. Department of Commerce [check] and used for reporting employment and output data by industry at the national, state and local level.

7. See O'hUallachain, op. cit., and Edward J. Malecki, "Innovation in the Firm: High Technology in the Corporate Context," Technology and Economic Development, 1991.

8. We use 1988 as a base year for comparison in this analysis because it is the first year in which employment is reported using the 1987 SIC categories and it precedes the period during which defense spending cuts began to affect employment levels. Thus, it gives a recent snapshot of California before defense cuts.

9. California's share of prime contracts is reported by the Commission on State Finance, Impact of Defense Cuts on California, 1992, and in Department of Defense, Prime Contract Awards by State, Fiscal Year 1992.

10. Bureau of Labor Statistics employment time series, the basis for this analysis, are published for nonagricultural jobs, only, excluding agricultural production (but not manufacturing)jobs. Because this sector is not closely linked to defense production activities or employment, we make no effort to include it in the analysis. California's share of the nation's agricultural jobs is only slightly higher than its share of

nonagricultural jobs; adding agricultural production jobs to the job base would not significantly change the comparisons discussed in this section.

11. Norman C. Saunders, "Employment effects of the rise and fall in defense spending," Monthly Labor Review, April 1993, pp. 3-10.

12. The input-output model results reported here were produced by George Goldman and Vijay Pradhan, of the Department of Agricultural and Resource Economics at the University of California at Berkeley in February 1993.

13. The percentage of the state economy including multiplier effects may be somewhat less than the 10 percent calculated from the multipliers. This is because a significant portion of spending for two of the sectors (aircraft and parts and search and navigation equipment) goes to other firms within the defense sectors that are already included in our basic defense employment numbers. The multiplier effect outside of defense jobs may be closer to 2.3 for search and navigation equipment jobs and to 2.0 for aircraft jobs than the numbers shown in Table 2.

14. Data used to estimate employment change in this analysis come from the California Employment Development Department and the U.S. Bureau of Labor Statistics (EDD and BLS, for 1988-1993), and from County Business Patterns (1988 to 1990) for ordnance, which is not reported separately from other fabricated metals sectors by EDD and BLS.

15. This would occur because employment in the "defense manufacturing" sectors discussed here is not entirely dependent on demand from the DOD. The reasons for this are discussed in the following section.

16. Our understanding of the COSF forecast methodology comes from several telephone conversations with Brad Williams, Executive Director of the Commission on State Finance, during summer and fall of 1993. The methodology is unpublished.

17. See Edward J. Malecki, "Military Spending and the U.S. Defense Industry: Regional Patterns of Military Contracts and Subcontracts," Environment and Planning C: Government and Policy, 2:31-44, 1984, and O'hUallachain, op. cit.

18. Markusen, Ann and Joel Yudken, Dismantling the Cold War Economy, New York: Basic Books, 1992.

19. This is discussed in Markusen, Ann and Joel Yudken, Dismantling the Cold War Economy, New York: Basic Books, 1992.

20. Markusen and Yudken 1992, page 215.

21. Markusen and Yudken, 1992, p. 214.

22. Alan Scott, ed., "Electric Vehicle Manufacturing in Southern California: Current Developments, Future Prospects," Working Paper No. 5, Lewis Center for Regional Policy Studies, June 1993.

23. A history of base closure experience in California is provided in Charlene Wear Simmons, Roger Dunstan, and Kenneth W. Umbach, "California Military Base Closure," California Research Bureau, Sacramento, April 14, 1993. A broader review of base closures nationwide, including several California bases, is reported in Business Executives for National Security, Base Closure and Reuse: 24 Case Studies, Washington, D.C., April 1993.

24. See for example, Ann Markusen, "The Economic and Regional Consequences of Military Innovation," Institute of Urban and Regional Development, Working Paper No. 442, May 1985, and Nance Goldstein, "Defense Spending as Industrial Policy: The Impact of Military R&D on the U.S. Software Industry," in Gregory A. Bischak, Ed., Towards a Peace Economy in the U.S.: Essays on Military Industry, Disarmament and Economic Conversion, New York: St. Martins Press, 1991.

25. Further details on state programs for defense recovery and for economic development more broadly are provided in Gus Koehler, State Government and California University Economic Development Programs, California Research Bureau, Sacramento, September 1993.

REFERENCES

Bahrami, Homan, 1992. "The Emerging Flexible Organization: Perspectives from Silicon Valley," California Management Review, 34(4): 33-52.

Beltramo, Michael, 1992. "Defense Contracting and the Los Angeles Economy," in Economic Roundtable, Los Angeles County Economic Adjustment Strategy for Defense Reductions, Los Angeles, CA: Economic Roundtable.

Bischak, Gregory A. ed, 1991. Towards a Peace Economy in the United States: Essays on Military Industry, Disarmament and Economic Conversion, New York: St. Marin's Press.

Brauer, Jurgen and John Tepper Marlin, 1992. "Converting Resources from Military to Non-Military Uses," The Journal of Economic Perspectives, 6(4): 145-164.

Breheny, Michael J. ed., 1988. Defense Expenditure and Regional Development, London: Mansell Publishing Ltd.

Bules & Associates, 1992. California Industry Migration Study,
San Francisco: report prepared for L.A. Dept. of Water and Power, PG&E, San Diego Gas and Electric, et al.

Bury, Elizabeth, 1992. "How Important is the Gunbelt: Some Empirical Evidence: A Critique of Ann Markusen, Peter Hall, Scott Campbell and Sabina Deitrick's The Rise of the Gunbelt," Berkeley Planning Journal, 7: 166-174.

Business Executives for National Security, 1992. Weathering the defense transition: a business based approach to conversion, Washington D.C.

_____, 1993. Base Closure and Reuse: 24 Case Studies, Washington D.C.

California Commission on State Finance, 1986. The Impact of Federal Expenditures on California, Sacramento, California.

_____, 1992. The Impact of Defense Cuts on California, Sacramento California.

California Research Bureau, 1993. California Military Base Closures, Sacramento CA.

CALSTART, 1992. Annual Report: CALSTART: A non-profit Consortium Developing Advanced Transportation Technologies.

Castells, Manuel ed., 1985. High Technology, Space, and Society,
Sage Publications Urban Affairs Annual Reviews, Vol. 28. Beverly Hills: Sage Publications.

Center for the Continuing Study of the California Economy, 1993. California Economic Growth, 1993 Edition, Palo Alto, CA.

Chinn, Menzie, 1991. "Beware of Econometrician Bearing Estimates: Policy Analysis in a 'Unit Root' World," Journal of Policy Analysis and Management, 10(4): 546-67.

Congressional Budget Office, 1992. The Economic Effects of Reduced Defense Spending, Washington D.C.: GPO.

Cooper, Arnold C., 1985. "The Role of Incubator Organizations in the Founding of Growth-Oriented Firms," Journal of Business Venturing, 1(1): 75-86.

Dean, Burton V. and Joseph J. Giglierano, 1990. "Multistage Financing of Technical Start-up Companies in Silicon Valley," Journal of Business Venturing, 5: 375-389.

Defense Conversion Commission, 1992. Adjusting to the Drawdown, Washington D.C.: GPO.

DeGrasse, Robert W. Jr., 1987. "Corporate Diversification and Conversion Experience," in John E. Lynch ed., Economic Adjustment and Conversion of Defense Industries, Boulder CO: Westview Press.

DiFilippo, Anthony, 1991. "Military Spending and Government High-Technology Policy: A Comparative Analysis of the U.S., West Germany, Japan and Great Britain." in Gregory A. Bischak ed., Towards a Peace Economy in the United States: Essays on Military Industry, Disarmamant and Economic Conversion, New York: St. Martin's Press.

Dubinsky, Odessa, 1992. "Reemployment Opportunities and Needs in the Aerospace High Technology Industry Complex," in Economic Roundtable, Los Angeles County Economic Adjustment Strategy for Defense Reductions, Los Angeles, CA: Economic Roundtable.

Economics Research Associates, 1993. Analysis of the Economic Impact of Closing the San Francisco Bay Area U.S. Naval Bases, report prepared for Alameda Economic development Advisory Board.

Esparza, Adrian, 1989. "Defense Impact Analysis within a Social Accounting Framework," Growth and Change 20(3): 63-79.

Flaming, Daniel, 1992. "Aerospace Workers and the Job Training System," in Economic Roundtable, Los Angeles County Economic Adjustment Strategy for Defense Reductions, Los Angeles, CA: Economic Roundtable.

_____ and Allen J. Scott, 1992. "Economic Adjustment Strategies for a Defense Dependent Industrial Base," in Economic Roundtable, Los Angeles County Economic Adjustment Strategy, Los Angeles, CA: Economic Roundtable.

_____ and Elizabeth Reid, 1992. "Technology Commercialization," in Economic Roundtable, Los Angeles County Economic Adjustment Strategy for Defense Reductions, Los Angeles, CA: Economic Roundtable.

Florida, Richard and Martin Kenney 1990. "Silicon Valley and Route 128 Won't Save Us," California Management Review, Fall 1990: 68-88.

Galbraith, Craig S., 1985. "High-Technology Location and Development: The Case of Orange County," California Management Review, 28(1): 98-109.

Garvin, David A., 1983. "Spin-Offs and the New Firm Formation Process," California Management Review, 25(2): 3-20.

Goldstein, Nance, 1991. "Defense Spending as Industrial Policy: The Impact of Military R&D on the U.S. Software Industry," in Gregory A. Bischak, ed., Towards a Peace Economy in the United States: Essays on Military Industry, Disarmament and Economic Conversion, New York: St. Martin's Press.

Governor's Office of Planning and Research, 1993. California Military Base Closures, Summary Information, Sacramento: CA.

Henseley, David G. and Daniel Fleming, 1992. "Economic Impacts of Defense Cutbacks," Economic Roundtable, Los Angeles County Economic Adjustment Strategy for Defense Reductions, Los Angeles, CA: Economic Roundtable.

Howland, Marie, 1988. Plant Closings and Worker Displacement: The Regional Issues, Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research.

Judge, George, et. al., 1980. The Theory and Practice of Econometrics, New York: Wiley.

Kirby, Andrew, ed., 1992. The Pentagon and the Cities, Urban Affairs Annual Reviews, No. 40, Newberry Park, CA: Sage Publications.

Koehler, Gus, 1993. State Government and California University Economic Development Programs, Sacramento CA: California Research Bureau.

Law, Robin M, Jennifer R. Wolch, and Lois Takahashi, 1991. The Future of Technopolis: Militarized Industrial Spaces in Southern California, Los Angeles Homelessness Project, Working Paper #31.

Lawson, James, 1987. "Civilian Market Opportunities for Defense Industry," in John E. Lynch ed., Economic Adjustment and Conversion of Defense Industries, Boulder CO: Westview Press.

Logistics Management Institute, 1992. From War to Peace: A History of Past Conversions, Bethesda MD: LMI Report DC201R4.

_____, 1993. A Method for Estimating Local Impacts of Cuts in Defense Spending, Bethesda, MD: LMI Report DC201R6.

_____, 1993. Impacts of Defense Spending Cuts on Industrial Sectors, Occupational Groups, and Localities, Bethesda, MD:
LMI Report DC201R2.

_____, 1993. The DoD Drawdown: Planned Spending and Employment Cuts, Bethesda, MD: LMI Report DC201R4.

Sedway & Associates, 1990. Highest and Best Use Analysis: Mather Air Force Base, report prepared with the Mather AFB Appraisal Team.

_____, 1992. Housing Impact Analysis of Fort Ord Downsizing, report prepared for Fort Ord Community Task Force.

Lynch, John E. ed., 1987. Economic Adjustment and Conversion of Defense Industries, Boulder CO: Westview Press.

MacLachlan, Ian, 1992. "Plant Closure and Market Dynamics: Competitive Strategy and Rationalization," Economic Geography, 68(2): 128-145.

Malecki, Edward J., 1983. "Technology and Regional Development: A Survey," International Regional Science Review 8(2): 89-125.

_____, 1984. "Military Spending and the U.S. Defense Industry: Regional Patterns of Military Contracts and Subcontracts," Environment and Planning C: Government and Policy, 2: 31-44.

_____, 1991. Technology and Economic Development: The Dynamics of Local, Regional, and National Change, New York: John Wiley & Sons, Inc.

_____, 1991. "Innovation in the Firm: High Technology in the Corporate Context," Technology and Economic Development, 1991.

_____ and P. Nijkamp, 1988. "Technology and Regional Development: Some Thoughts on Policy," Environment and Policy C, 6: 383-399.

Markusen, Ann, 1985. "The Economic and Regional Consequences of Military Innovation," Institute of Urban and Regional Development, University of California, Berkeley working paper 442.

_____, 1992. "Why Shifting Gears is not easy: Structural Barriers to Macroeconomic Adjustment," in Manas Chatterji and Jurgen Brauer, The Economics of Disarmament, New York: New York University Press.

_____ and Robin Bloch, 1985. "Defensive Cities: Military Spending, High Technology, and Human Settlements," in Manuel Castells ed., High Technology, Space, and Society, Beverly Hills: Sage Publications, Sage Publications Urban Affairs Annual Reviews.

_____ et.al., 1985. "Military Spending and Urban Development in California," Berkeley Planning Journal, 1(2): 54-68.

_____ and Joel Yudken, 1992. Dismantling the Cold War Economy, New York: Basic Books.

_____, Peter Hall, Scott Campbell, and Sabina Deitrick, 1991. The Rise of the Gunbelt, New York: Oxford University Press.

_____, 1992. "Rejoinder to Elizabeth Bury," Berkeley Planning Journal, 7: 175-181.

Mehay, Stephen L. and Loren M. Solnick, 1990. "Defense Spending and State Economic Growth," Journal of Regional Science. 30:477-487.

O'hUallachain, Breandan, 1987. "Regional and Technological Implications of the Recent Growth in American Defense Spending," Annals of the Association of American Geographers, 72:208-23.

Pindyck, Robert and Daniel Rubinfeld, 1981 and 1990, Econometric Models and Economic Forecasts, New York: McGraw-Hill, second and third editions.

Reid, Elizabeth, 1992. "Defense Dependence and Growth Expectations in the Aerospace Industry," in Economic Roundtable, Los Angeles County Economic Adjustment Strategy for Defense Reductions, Los Angeles, CA: Economic Roundtable.

Renner, Michael, 1992. Economic Adjustment after the Cold War: Strategies for Conversion, United Nations Institute for Disarmament Research.

Reppy, Judith, 1992. "Defense Companies' Strategies in a Declining Market: Implications for Government Policy," unpublished paper.

_____, 1993. "U.S. Defense Industry: Unmanaged Change," in Herbert Wulf, Arms Industry Limited, SIPRI.

Saunders, Norman C, 1993. "Employment Effects of the Rise and Fall in Defense Spending," Monthly Labor Review, April 1993: 3-10.

Saxenian, AnnaLee, 1990. "Regional Networks and the Resurgence of Silicon Valley," California Management Review, Fall 1990: 89-112.

_____, 1991. "A Response to Richard Florida and Martin Kenney, 'Silicon Valley and Route 128 Won't Save Us," California Management Review, Spring 1991: 136-142.

_____, 1991. "Institutions and the Growth of Silicon Valley," Berkeley Planning Journal, 6:36-57.

_____, 1991. "The Origins and Dynamics of Production Networks in Silicon Valley," Research Policy, 20: 423-437.

Schoenberger, Erica, 1989. "Some Dilemmas of Automation: Strategic and Operational Aspects of Technological Change in Production," Economic Geography 65(3):232-247.

Scott, Allen J., 1992 "Growth and Future Prospects of the Aerospace-Defense Industry in Los Angeles County," in Economic Roundtable, Los Angeles County Economic Adjustment Strategy for Defense Reductions, Los Angeles, CA: Economic Roundtable.

_____ ed., 1993. "Electric Vehicle Manufacturing in Southern California: Current Developments, Future Prospects," working paper #5, Lewis Center for Regional Policy Studies, University of California, Los Angeles.

_____ and A. Paul, 1990. "Collective Order and Economic Coordination in Industrial Agglomeration: The Technopolies of Southern California," Environment and Planning C, 8: 179-193.

_____ and Doreen J. Mattingly, 1989. "The Aircraft and Parts Industry in Southern California: Continuity and Change from the Inter-War Years to the 1990s," Economic Geography 65(1): 48-71.

Sedway & Associates, 1990. "Highest and Best Use Analysis, Mather AFB," San Francisco, report prepared by Mather AFB Appraisal Team.

_____, 1992. "Housing Impact Analysis of Fort Ord Downsizing," San Francisco, report prepared for the Fort Ord Community Task Force.

Senker, Peter, 1992. "Technological Change and the Future of Work: An Approach to an Analysis," Futures, May 1992: 351-363.

Shapira, Philip, 1984. "The Crumbling of Smokestack California: A Case Study in Industrial Restructuring and the Reorganization of Work," Institute for Urban and Regional Development, University of California, Berkeley Working Paper 437.

_____, 1986. Industry and Jobs in Transition: A Study of Industrial Restructuring Displacement in California. Ph.D. dissertation, City and Regional Planning, UC at Berkeley.

_____, 1987. "Industrial Restructuring and Worker Transition in California Manufacturing," Institute for Urban and Regional Development, University of California, Berkeley Working Paper 452.

Simmons, Charlene Wear, Roger Dunstan, and Kenneth W. Umbach, 1993. "California Military Base Closure," Sacramento, CA: California Research Bureau.

Stowksy, Jay, 1989. "Regional Histories and the Cycle of Industrial Innovation: A Review of Some Recent Literature," Berkeley Planning Journal, 4: 114-124.

_____, 1991. "Beating our Plowhares into Double-edged Swords: The Impact of Pentagon Policies on the Commercialization of Advanced Technologies," Berkeley Roundtable on the International Economy, University of Berkeley.

_____, 1991. "From Spin-off to Spin-on: Redefining the Military's Role in Technology Development," Berkeley Roundtable on the International Economy, University of California, Berkeley.

Teitz, Michael and Philip Shapira, 1989. Growth and Turbulence in the California Economy, Morgantown, VA: Regional Research Institute.

United States Congress, 1993. National Defense Authorization Act for Fiscal Year 1993, Public Law 102-484.

United States Department of Defense, 1992. Prime Contracts Awards by State, Washington D.C.: GPO.

White House, 1993. Defense Reinvestment and Conversion White Paper, President Clinton Position Paper.

Wolch, Jennifer R., Robin Law, and Lois Takahashi, 1990. Defense Industries, Workers, and Communities in Los Angeles County,
Los Angeles Homelessness Project: Working Paper #28.

Appendix A

Defense Employment Forecasting Model

To forecast future employment levels in the California defense sector we estimate an econometric model that explains the level of California defense sector employment as a function of the amount of defense prime contracts received by California and general macroeconomic conditions. Specifically, we employ a partial stock adjustment model (Pindyck and Rubinfeld 1981, 235). It is assumed that firms do not instantaneously adapt to changing circumstances. Rather, each year firms calculate their optimal level of employment given the amount of contracts they receive and macroeconomic conditions. They adjust their existing labor force toward this optimal level, but because of information and labor market constraints, the adjustment is not complete.

Formally, in this model current employment is determined by:

(1) $LEMP_t = LEMP_{t-1} + \sigma(LEMP_t^* - LEMP_{t-1}) \quad 0 < \sigma < 1$

Where:

$LEMP_t$ is the log of total California employment in year t in six defense related industries: ordnance and accessories (SIC 348), communications equipment (SIC 366), aircraft and parts (SIC 372), ship building and repair (SIC 373), guided missiles and space vehicles (SIC 376), and search and navigation equipment (SIC 381).
$LEMP_t^*$ is the optimal level of California defense employment in year t.

(The sources for these and other data are reported at the end of this appendix.)

The optimal level, in turn, is determined by:

(2) $LEMP_t^* = \alpha + ß_1 * LCON_t + ß_2 * GNPCH_{t-1} + \Theta_t$

Where:

$LCON_t$ is the log of total prime contracts awarded to California in year t. (measured in constant 1987 dollars)

$GNPCH_{t-1}$ is the percentage increase in Gross National Product (also measured in 1987 dollars) in the year t-1.

By substituting the right hand side of equation (2) for $LEMP_t^*$ in equation (1) and solving for $LEMP_t$, we arrive at:

(3) $LEMP_t = a + b_1 * LEMP_{t-1} + b_2 * LCON_t + b_3 * GNPCH_{t-1} + e_t$

This model can be estimated employing historical data. Then the estimated

coefficients can be combined with predictions of future levels of prime contract awards to California and macroeconomic conditions to forecast defense sector employment.

Estimation, however, involves two complications. First, there is a question whether this model correctly reflects the underlying economic relationship. Second, the error terms in equation (3) are likely to be serially correlated, and the lagged term of the dependent variable in the right hand side of the equation is correlated with the error term. Thus, OLS procedures yield biased and inconsistent estimates of the coefficients.

As currently specified, this model is based on a deterministic relationship between employment and defense spending. Specifically, changes in defense spending translate into only short run changes in employment. In the long run employment is assumed to return to some stable level. Many economic time series, however, are not properly modeled in this way. Shocks to some economic series (e.g. commodity prices or exchange rates) may be permanently incorporated in future levels of the series. When this relationship holds, the series is said to be generated from a unit root process, and our existing model yields misleading results.

There are several tests to determine which model specification is appropriate. One heuristic test is to examine a graph of a series over time (Chinn 1991, 558). If the time series does not exhibit a clear upward trend, it can be assumed that the series is properly modeled as a deterministic relationship. On this count, our existing model appears appropriate because defense employment exhibits no clear trend over time. A second test is to examine the autocorrelation function of the dependent variable. If the function rapidly drops to zero as the lag increases, a deterministic model is usually appropriate. Again, this test supports the use of a deterministic model.

The formal test to determine whether a series is generated from a unit root process is the Dicky-Fuller test (Pindyck and Rubinfeld 1990, 459). In this test, in contrast, we are unable to reject the null hypothesis that the series is a unit root process. It is, however, often difficult to reject the null hypothesis, even if it is not true, when the test is conducted on relatively short time series (e.g. less than 100 years). Thus, given the evidence from the two less formal tests we conclude that our deterministic model is appropriate.

To correct for autocorrelation of the error terms we assume that the error terms are related by a first order Markov process:

(4) $e_t = p * e_{t-1} + \Theta_t$

Equation (3) can then be estimated employing an iterative grid search method (Judge et. al. 1980, 667). The equation is rewritten to explicitly incorporate the autocorrelation coefficient, p. This new equation is iteratively estimated as p is varied between -1 and 1 in one tenth gradations. The regression that minimizes the sum of squared errors is selected and simultaneously yields estimates of p and the coefficients. (Because of the structure of the model employed in the iterative search, the estimated intercept coefficient must be divided by (1-p) to attain the intercept for equation (3).) Employing data from 1964 through 1992 the results are:

Dependent Variable - $LEMP_t$
N = 27

Variable	Coefficient	
CONSTANT	1.314	
	(1.72)	
$LEMP_{t-1}$	0.659	
	(6.63)	
$LCON_t$	0.247	
	(3.75)	
$USGNPCH_{t-1}$	1.265	R-squared = .841
	(2.96)	p = .3

The numbers reported in parentheses are the t-statistics for the coefficients. This estimated model predicts the variation in defense employment closely. All of the coefficients except the intercept are statistically significant at the 1% level and have reasonable signs. (The number of observations is only 27 because of lagged variables.)

The Forecast:

To forecast employment in the defense sector through 1997 we then combine the coefficients from our estimated model with several assumptions of the future level of prime contracts received by California and economic growth.

Economic Growth. Three different forecasts of economic growth are employed. Each is based on the November 1992 DRI Long-Term Projections with some adjustments incorporated. The DRI estimate for 1993 growth (2.37%) was much higher than actual growth during the first six months of 1993. Thus, we assume in each scenario that GNP will grow at only a 1.37% rate in 1993. The scenarios then differ on out year projections. The baseline estimate assumes that the economy will grow at a 1% slower rate than the DRI forecast in 1994 and then grow at the rate DRI predicts. The slow growth scenario assumes that the economy grows 1% more slowly than the DRI forecast every year. The rapid growth scenario assumes that in 1994 the economy will grow .5% less than predicted, but in every subsequent year it will grow .5% more rapidly. The resulting estimates are:

PROJECTED GNP GROWTH

YEAR	BASELINE	PESSIMISTIC	OPTIMISTIC
1993	1.365	1.365	1.365
1994	2.255	2.255	2.755
1995	2.633	1.633	3.133
1996	2.978	1.978	3.478
1997	-1.255	-2.255	-0.755

California Defense Spending. We assume that two factors affect the level of California defense spending: the overall level Department of Defense procurement and R&D spending and the proportion of defense spending received by California. We develop projections for total defense contracts based on projected total Department of Defense budget authority as reported in President Clinton's budget released in April, 1993. We assume that national procurement and R&D spending will decrease at the same rate as the overall budget. We then examine three possible scenarios for the proportion of total spending received by California: 16%, 19%, and 22%. Over the last 20 years California has received between 18.4% and 23%. Thus, these assumptions are on the low side. These assumptions yield three estimates of future prime contract spending in California:

PROJECTED PRIME CONTRACT AWARDS TO CALIFORNIA
(millions of 1987 dollars)

YEAR	BASELINE	PESSIMISTIC	OPTIMISTIC
1993	$14,495	$12,206	$16,783
1994	$13,718	$11,552	$15,884
1995	$13,249	$11,157	$15,341
1996	$12,533	$10,554	$14,512
1997	$11,906	$10,026	$13,786

Projections: We develop three forecasts of defense employment through 1997 by combining the baseline, pessimistic, and optimistic forecasts for GNP growth and prime contracts. The results are:

PROJECTED CALIFORNIA DEFENSE SECTOR JOBS

YEAR	BASELINE	PESSIMISTIC	OPTIMISTIC
1993	304,364	291,735	315,565
1994	287,679	268,144	305,462
1995	277,923	254,323	301,683
1996	269,262	240,362	296,562
1997	261,519	229,661	290,806
Total job Loss/gain	-23,522	-55,380	+5,765

The job loss or gain is calculated from the average defense employment for the first five months of 1993.

Caveats: Given recent experience cuts in defense employment, all of these forecasts, unfortunately, appear too high. Over the first seven months of 1993 employment in the six defense industry SIC codes has already dropped to around 280,000. If this rate of decrease continues, annual average employment for 1993 will be 272,000, the number reported in the tables of this report.

There are several possible explanations for our model's failure to predict the rapid deterioration in employment in 1993. First, there may have been a recent decrease in the amount of secret defense contracts received by California firms. The prime contract series employed to estimate the forecasting model only reports the total amount of unclassified contracts. If California has experienced a disproportionately high decrease in secret contract awards, our model and forecasts would fail to pick up the effects of this change.

Second, the rapid decrease in employment may be attributable to business flight. There exists some anecdotal evidence that large defense contractors are relocating their operations out of California. The Commission on State Finance, for one, emphasizes this factor. Nevertheless, it appears doubtful that business flight can fully explain the loss in jobs. As seen in the subsequent table, according to our model California's share of national defense contracts would have to drop to 12% for employment to drop to current levels.

PROJECTED CALIFORNIA DEFENSE SECTOR JOBS DEPENDING ON CALIFORNIA SHARE OF TOTAL U.S. DEFENSE PRIME CONTRACTS

YEAR	14%	13%	12%	11%	10%
1993	282,287	277,177	271,759	265,992	259,814
1994	253,888	246,304	238,368	230,031	221,233
1995	237,376	228,463	219,213	209,580	199,514
1996	222,237	212,775	203,006	192,895	182,397
1997	211,025	201,344	191,385	181,115	170,498

A decrease to this level appears unlikely from a historical perspective. In 1992 California received 21.2% of all unclassified contract awards. Moreover, California's share has never dipped below 17.4% in the last 25 years, and during the last significant drop in defense spending (1968-1973), California's share of total contracts actually increased slightly.

Third, the rapid decrease in employment may be attributed to a behavioral shift on the part of defense firms. Our model assumes that firms continue to have the same response to changing levels of contracts and GNP growth as they have had over the last 25 years. Nevetheless, with the end of the Cold War and with certain and prolonged defense cuts coming, firm perceptions are likely to have shifted. Specifically, defense firms, instead of reacting to past levels of contracts, may be rapidly adjusting their post-Cold War employment levels in anticipaton of coming lean times. If this behavioral

explanation is true, it helps explain the speed of job losses, but we would expect that long run employment would continue to accord with the fundamental relationship estimated in our model. In this case our forecasts of total job losses through 1997 are likely to be fairly accurate even if our short term forecasts fail to track actual job losses.

DATA SOURCES

Defense employment - Employment data for 1964 through 1982 is taken from County Business Patterns. From 1983 through 1992 the data is from the California Employment Development Department June 1993 benchmark revisions. The one exception are the figures for employment in ordnance. Figures for 1964 to 1990 are from County Business Patterns. The 1991 through 1993 figures are estimates based on the percentage change in the 2-digit SIC grouping, Fabricated Metals, that includes ordnance.

Prime Contracts Awarded to California - These figures are compiled from the Commission on State Finance, Impact of Federal Expenditures on California, August 1986, Commission on State Finance, Impact of Defense Cuts on California, Fall 1992, and Department of Defense, Prime Contract Awards by State, 1992.

In 1991 the Department of Defense declassified the B-2 Bomber program and began to report these expenditures with other prime contract awards. (Secret contracts are excluded from the DOD's Prime Contract Awards reports.) This declassification gave the appearance that total defense spending in California increased in 1991 even though it was decreasing. To account for this anomaly, we subtracted the total amount spent on the B-2 Bomber program from the series: $2.34 billion in 1991 and $2 billion in 1992 in current dollars. The series was converted into constant 1987 dollars with the GDP implicit price deflator.

GNP Growth - These historical figures are from the Economic Report of the President and the Bureau of Economic Analysis, Survey of Current Business. The forecasted growth rates are from DRI Ten-year Projections, November 1992.

Projected Defense Spending - These figures are from the Budget of the United States, April 1993.

DATA

Year	California Defense Employment	Total Prime Contracts	Percent of Total U.S. Contracts	U.S. GNP Growth
1964	371,336	18,414		5.64%
1965	349,236	18,147		5.55%
1966	380,123	19,772		5.90%
1967	418,607	22,075		2.64%
1968	452,288	20,416	17.4%	4.16%
1969	422,788	20,494	19.4%	2.72%
1970	374,100	16,592	19.6%	0.03%
1971	298,186	14,304	18.5%	2.85%
1972	302,705	15,504	18.7%	5.12%
1973	305,986	15,047	20.7%	5.20%
1974	313,206	15,372	21.2%	-0.63%
1975	305,524	16,139	21.2%	-0.81%
1976	285,932	17,210	23.0%	4.94%
1977	288,531	17,997	22.1%	4.51%
1978	295,893	17,528	19.6%	4.82%
1979	324,431	17,688	20.6%	2.52%
1980	365,123	19,326	20.4%	-0.54%
1981	363,891	21,138	19.0%	1.77%
1982	380,512	27,005	21.8%	-2.15%
1983	383,407	30,330	22.2%	3.89%
1984	396,540	31,340	23.0%	6.19%
1985	429,606	31,005	20.8%	3.16%
1986	447,012	28,596	20.4%	2.91%
1987	439,983	24,515	18.4%	3.07%
1988	413,084	22,577	18.7%	3.94%
1989	401,744	21,333	19.3%	2.53%
1990	385,230	19,728	18.4%	0.82%
1991	353,828	20,598	18.0%	-1.16%
1992	320,177	19,721	19.8%	2.11%

Note: 1991 and 1992 contract amounts and percentages are adjusted to exclude B-2 Bomber expenditures. See Data Sources section for explanation.

REFERENCES

Chinn, Menzie, 1991. "Beware of Econometrician Bearing Estimates: Policy Analysis in a 'Unit Root' World," Journal of Policy Analysis and Management, 10(4): 546-67.

Judge, George, et. al., 1980. The Theory and Practice of Econometrics, New York: Wiley.

Pindyck, Robert and Daniel Rubinfeld, 1981 and 1990, Econometric Models and Economic Forecasts, New York: McGraw-Hill, second and third editions.

Appendix B

BRAC Base Closure List

California Base Closures and Realignments
Personnel movements

	BRAC I		BRAC II		BRAC III		BRAC TOTAL		
	Mil.	Civ.	Mil.	Civ.	Mil.	Civ.	Mil.	Civ.	Total
c Hamilton Army Airf	(26)	(3)					(26)	(3)	(29)
c Presidio	(2,140)	(3,150)					(2,140)	(3,150)	(5,290)
c Moffet/NASA Ames			(3,359)	(633)	348	105	(3,011)	(528)	(3,539)
c Hunters Pt Annex			(5)	(63)			(5)	(63)	(68)
c NESEC Vallejo			(8)	(314)			(8)	(314)	(322)
c Alameda NAS/Depot			215	19	(11,062)	(3,238)	(10,847)	(3,219)	(14,066)
c Oakland NSS			874	1	(2,374)	(948)	(1,500)	(947)	(2,447)
c Naval Hosp. Oak.					(1,472)	(809)	(1,472)	(809)	(2,281)
c Mare Island NS					(1,963)	(7,567)	(1,963)	(7,567)	(9,530)
c Treasure Isl.					(637)	(454)	(637)	(454)	(1,091)
c Hunters Point NS	(4,132)	(93)					(4,132)	(93)	(4,225)
r Misc. SF Army	138	776					138	776	914
r Def Depot Oakland					(427)	0	(427)	0	(427)
r Travis AFB					1,077	59	1,077	59	1,136
r Naval Works, SF					(10)	(1,834)	(10)	(1,834)	(1,844)
BAY AREA TOTAL	(6,160)	(2,470)	(2,283)	(990)	(16,520)	(14,686)	(24,963)	(18,146)	(43,109)
c Mather AFB	(1,988)	(1,012)					(1,988)	(1,012)	(3,000)
c Sac Army Depot			(334)	(3,164)			(334)	(3,164)	(3,498)
c McClellan AFB	22	209			(3,121)	(10,406)	(3,099)	(10,197)	(13,296)
SACRAMENTO TOTAL	(1,966)	(803)	(334)	(3,164)	(3,121)	(10,406)	(5,421)	(14,373)	(19,794)
c Fort Ord			(13,619)	(2,835)			(13,619)	(2,835)	(16,454)
c Presidio (DLI)					(3,626)	(1,239)	(3,626)	(1,239)	(4,865)
r Beale AFB	588	193	(588)	(193)	0	243	0	243	243
OTHER N. CAL.	588	193	(14,207)	(3,028)	(3,626)	(996)	(17,245)	(3,831)	(21,076)
NORTHERN CA TOTAL	(7,538)	(3,080)	(16,824)	(7,182)	(23,267)	(26,088)	(47,629)	(36,350)	(83,979)
c Castle AFB			(5,239)	(1,164)			(5,239)	(1,164)	(6,403)
r Lemoore NAS			5,945	231	4,629	317	10,574	548	11,122
CENTRAL CA TOTAL	0	0	706	(933)	4,629	317	5,335	(616)	4,719

	BRAC I		BRAC II		BRAC III		BRAC TOTAL		
	Mil.	Civ.	Mil.	Civ.	Mil.	Civ.	Mil.	Civ.	Total
c George AFB	(4,852)	(506)					(4,852)	(506)	(5,358)
c Norton AFB	(4,520)	(2,133)					(4,520)	(2,133)	(6,653)
c Long Beach NS	356	5	(9,519)	(833)			(9,163)	(828)	(9,991)
c Tustin MCAS			(4,105)	(348)			(4,105)	(348)	(4,453)
c El Toro MAS					(5,689)	(979)	(5,689)	(979)	(6,668)
r Con. Mgmt. Dist.					0	136	0	136	136
r March AFB	2,238	1,182			(2,961)	(997)	(723)	185	(538)
LA/SB/OC TOTAL	(6,778)	(1,452)	(13,624)	(1,181)	(8,650)	(1,840)	(29,052)	(4,473)	(33,525)
c ICSTF San Diego			(276)	(41)			(276)	(41)	(317)
c San Diego NTC					(5,186)	(402)	(5,186)	(402)	(5,588)
c NESEC San Diego			0	(619)			0	(619)	(619)
r San Diego NS	1,473	22	4,380	115	4,423	111	10,276	248	10,524
r Pendleton Hosp.			137	78			137	78	215
r NOSC San Diego			0	1,140			0	1,140	1,140
r San Diego NCTS					0	(170)	0	(170)	(170)
r MCAS Pendleton					949	0	949	0	949
r NAS Miramar					1,729	(254)	1,729	(254)	1,475
r NAS North Island					3,982	47	3,982	47	4,029
r NAD North Island					3	1,889	3	1,889	1,892
r Naval Hospital SD					622	59	622	59	681
SAN DIEGO TOTAL	1,473	22	4,241	673	6,522	1,280	12,236	1,975	14,211
r Pt. Mugu			2	(157)			2	(157)	(155)
r 29 Palms			4,194	227	(3,225)	0	969	227	1,196
r Edwards AFB			766	336			766	336	1,102
r China Lake			0	(131)	65	202	65	71	136
OTHER SC/DESERT	0	0	4,962	275	(3,160)	202	1,802	477	2,279
SOUTHERN CA TOTAL	(5,305)	(1,430)	(4,421)	(233)	(5,288)	(358)	(15,014)	(2,021)	(17,035)
CALIFORNIA TOTAL	(12,843)	(4,510)	(20,539)	(8,348)	(23,926)	(26,129)	(57,308)	(38,987)	(96,295)

Source: Office of Economic Adjustment (DoD)
CA CoSF, for McClellan and Monterrey Presidio
Note: Base closures or realignments affecting fewer than 100 persons are excluded