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ABSTRACT

Recent world developments have created an opportune time for nations to vigorously pursue a policy of converting the huge portion of their economies that traditionally have been devoted to military expenditures to more socially productive uses. This paper outlines a strategy for such a conversion, and discusses the issues that must be confronted in such a process. Specific aspects of conversion include: (1) misconceptions about lessening military spending; (2) building a conversion coalition; (3) the paths forged by China and the Soviet Union; (4) upheaval in Eastern Europe; and (5) grassroots initiatives in the West. It is concluded that the gathering pressure for disarmament suggests that conversion will be a topic gaining importance during the 1990's. A number of statistical tables, charts, and maps appear throughout this paper, and 127 endnotes are provided. (DB)

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Swords Into Plowshares: Converting to a Peace Economy

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Introduction

Since biblical times, people have been admonished to beat swords into plowshares. Never has such advice been more appropriate. Not only has the relentless pursuit of ever more sophisticated military means left nations defenseless and thus less secure, but the priorities of the global arms race have also kept them from meeting pressing social and environmental needs.

Crushing poverty, rampant disease, and pervasive illiteracy characterize the lives of hundreds of millions in the Third World. At the same time, a growing underclass has emerged in industrial countries; victims of social neglect, some inner-city areas resemble war zones. Nations devoting a large portion of their wealth to the military have done so at the expense of economic vitality. All of humanity—whether rich or poor, militarily strong or weak—confronts the specter of unprecedented environmental devastation. Excessive military spending may not be the root cause of all these problems. But the devotion of large-scale resources to building military power has unquestionably contributed to our inability to address them adequately.[1]

The world now has a unique opportunity to dismantle a large portion of its war-making capabilities and redirect society's priorities. To do so without causing social and economic dislocation requires a planned process of transferring resources from military to civilian purposes, known as economic conversion. The political climate has suddenly become more conducive to this option. China and the Soviet Union have gone furthest down this road; their top-down approach contrasts sharply, however, with the situation in the West, where conversion demands are bubbling up from a vibrant grassroots movement.

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Following a decade that started with a rash of new wars and confrontation, diplomacy and overtures toward disarmament are renewing hopes for a less violent world. While many small conflicts continue to rage, several hot spots—the Persian Gulf, Nicaragua, Namibia, and Angola—are cooling off. The cold war that has gripped us for almost half a century is waning, with one of its symbols—the Berlin wall—crumbling and reduced to irrelevance.[2]

In the wake of the democratic upheaval in Eastern Europe, the Warsaw Pact has ceased to exist as a viable and functioning organization. Inevitably, the rationale for the continued existence of the North Atlantic Treaty Organization (NATO) is withering too. Numerous uncertainties do remain, most notably the role of a unified Germany and the re-emergence of long-suppressed ethnic animosities in Eastern Europe. Yet it seems likely that a future European security system will revolve around continent-spanning rather than confrontational institutions. Economic and environmental cooperation have already begun to supplant military concerns.

Major arms control and disarmament treaties now in the offing could release a fair amount of resources, although the dramatic transformation of East-West relations calls for disarmament measures that go even further. The proposed Strategic Arms Reductions Talks (START) agreement may cut U.S. and Soviet strategic nuclear weapons by roughly one-third. In Europe, strong momentum is building for denuclearization and a sharp reduction of conventional forces. In the chemical weapons arena, U.S. and Soviet negotiators are edging toward outlawing future production and drastically cutting existing stockpiles; talks in Geneva are aimed at mandating a global ban on the possession of any poison gas. Equally if not more important than these codified measures are the unilateral reductions taking place within the Warsaw Pact.[3]

All these developments are accompanied by budgetary pressures on virtually every government to rein in military spending. The U.S. military budget has begun to level off in real terms, and the Soviets have announced significant cutbacks. Worldwide, arms export sales have declined—from a peak of about $57 billion in 1984 to $47 billion in 1987—due largely to economic crises in many developing nations.

"The cold war may be over, but bureaucratic institutions with vested interests in a perpetual arms competition remain intact."

(Although several developing countries, it should be noted, are expanding their own capacity to manufacture arms.) The global arms budget, an estimated $1 trillion per year, may have peaked.[4]

A number of considerations temper the euphoria over these welcome developments. The cold war may be over, but scientific, industrial, and bureaucratic institutions with vested interests in a perpetual arms competition remain intact. Yearning for the predictability they had grown accustomed to over the past half-century, many decision makers seem hard put to adjust to the new global realities: diminished East-West tensions have robbed military bureaucracies and contractors of their *raison d'être*. So it is not surprising to find strategists and pundits alike busy searching for new enemies in an effort to ward off substantial cuts in arms production.[5]

Indeed, if arms-control-as-usual continues to take precedence over disarmament, then reducing the numbers of weapons might largely be offset by increased technological sophistication. In its 1990 Yearbook, the Stockholm International Peace Research Institute finds "no evidence that there will be a slower pace of technological change in the military area."[6]

On balance, a considerable reduction in the size of the world's armaments industries is nevertheless likely. This will occur against the backdrop of already large overcapacities. Cuts and changes in military doctrine befitting the historic changes in the East-West relationship have yet to materialize, but the shrinking process is clearly under way.

Few governments have demonstrated the vision, expertise, or institutional commitment required to reverse the arms buildup. Likewise, just about every individual longs for peace, but few people have concrete ideas on how to get there from here. As Lloyd Dumas, Professor of Political Economy at the University of Texas in Dallas, points out, "it is not enough to have a vision of the Emerald City; there must also be a workable plan for building the yellow brick road."[7]

Economic conversion first of all implies a reallocation of budgets to make funds available for nonviolent purposes. But it is more than just a

bookkeeping exercise: conversion encompasses an adaptation of research, production, and management practices in arms-producing factories to civilian needs and criteria. This requires a retraining of employees as much as a refashioning of production equipment. And it means finding civilian uses for military bases and personnel.

Yet, conversion writ large goes beyond the plant and base level, offering an opportunity to re-examine the fundamental directions in which society is moving. Implicit in the demand for conversion is the question "conversion to what?" What products, technologies, and organizational structures should replace the war system? In addition, who should determine the pace and direction? Seen in this wider dimension, conversion is an endeavor of social change—a quest for achieving a greater degree of public accountability and democratic decision making applicable both in the military and civilian domain.[8]

This shift challenges orthodox notions of economic policy. It is unlikely to succeed under the conditions of bureaucratic centralism, and indeed the Soviet Union is struggling to shake off the rigidities of its economic system. Western countries, on the other hand, may well discover that to smooth the adjustment to a post–cold war world, they will need to retreat from laissez-faire. In any event, no single conversion blueprint is suitable for all the world's diverse economies. Each country must chart its own special path toward a peace economy, judging the degree of government involvement desirable, deciding how much leeway to give communities and regions, and determining whether conversion should be targeted toward expanding the supply of consumer goods or providing "socially useful" products and services like health care and education programs, public infrastructure, and environmental protection.

A Profile of Conversion

Between 1968 and 1974, as the Vietnam War was winding down, U.S. military procurement outlays were slashed by 40 percent. Arms-producing firms responded to this downturn by "diversifying" rather than attempting conversion. Diversification usually refers to a defense contractor's attempts to lessen reliance on military orders simply by rid-

ding itself of military divisions and acquiring civilian-oriented companies. Yet such strategies are not concerned with identifying alternative uses for the work force and equipment previously tied up in military production. In fact, they often go hand in hand with plant closures and massive layoffs.[9]

In the aftermath of Vietnam, according to Greg Bischak of Employment Research Associates in Lansing, Michigan, "there was no retraining of the workers, no retooling of military production lines to move into civilian markets, and no planning for the transition into alternative markets through the reuse of existing resources." Today, many military contractors in the United States and Western Europe are again taking this route. Diversification may be good for a company's balance sheets, but its value to society is questionable.[10]

Conversion offers a more comprehensive approach. With such a strategy in place, reversing the arms buildup becomes a social and economic opportunity, not a penalty. It pulls together the political, economic, and technical processes needed to release skills, equipment, and other resources now being used for military-oriented purposes and guides their transfer to alternative civilian uses. To be sufficiently prepared for disarmament, all military-related facilities need to map out an alternative use strategy ahead of time rather than wait until military contracts actually run out. Advance planning entails making an inventory of existing skills and equipment at all such facilities, assessing how disarmament measures will affect individual sites and communities, identifying alternative civilian products, conducting engineering studies to determine the feasibility of producing these goods with present capabilities, retraining employees and refashioning machinery and production layouts where needed, and preparing marketing studies to ascertain whether the alternative products can generate sufficient demand.[11]

These tasks are best tackled in a decentralized manner—by those most familiar with local opportunities and obstacles. "Alternative use committees" composed of representatives from management and workers of a military facility, and aided by observers from the community, are crucial to any conversion endeavor. They would be entrusted with

preparing a conversion "blueprint," a plan ready to be implemented once military contracts are terminated.[12]

10 A potential stumbling block for any adjustment strategy is the deeply ingrained work habits of military-industry employees. After decades of singular attention to military specifications, arms producers have, in the judgment of Seymour Melman, chair of the private National Commission for Economic Conversion and Disarmament in Washington, D.C., developed a "trained incapacity" to manufacture cheap and reliable civilian products. Production and clerical workers can be relatively easily transferred to civilian employment, but scientists, engineers, and managers must be retrained for conversion to be successful. Management practices in the military sector are geared to the demands of a single customer; cost considerations are secondary. Military industry engineers tend to be overspecialized; they are accustomed to choosing unusually expensive materials and technologies in order to meet performance requirements of a complexity both unnecessary and unacceptable in the civilian sphere.[13]

The experience of Boeing-Vertol of Philadelphia illustrates the problems of entering civilian markets without proper retraining and reorientation. The company sought to decrease its dependence on military orders after the Vietnam War by manufacturing trolley cars for the Massachusetts Bay Transit Authority. The cars failed to meet such crucial civilian design criteria as simplicity and durability. They proved so unreliable and required such costly repairs and modifications that most were taken out of service after only a few years. Similar problems have been encountered by the Rohr Corporation and by Westinghouse Military Electronics, which manufactured trains and electronic control systems for San Francisco's Bay Area Rapid Transit system, and by Grumman Corporation, which produced motor buses for New York City. Forays by Rockwell and Grumman into the production of televisions, refrigerators, and solar energy systems have been similarly unsucessful.[14]

Conversion attempts that are closer to the area of specialization of military industry firms may be technically more successful but less desirable from a different perspective. For example, the prominent Soviet

"Arms producers have developed a 'trained incapacity' to manufacture cheap and reliable civilian products."

warplane manufacturer Sukhoi has teamed up with the Gulfstream Aerospace Corporation to produce supersonic jets for western business executives. Hardly a shining example of a socially useful product, the plane would cost twice as much as the most expensive corporate jet on the market today and pose considerable environmental problems.[15]

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The most immediate task before conversion can start is to identify the resources involved in the military sector. On one side, there are the "users"—the armed forces, defense procurement and planning bureaucracies, and the bases and other facilities at their disposal. On the other side are the "producers"—the complex of research and design laboratories, and an enormous array of arms production sites. These range from facilities that specialize in items of exclusively military use (such as tanks, missiles, and explosives) to those that manufacture products with dual applications (such as the output of the electronics industry) and those that provide the armed forces with products and services (such as motor vehicles, fuel, and food) that can be sold equally well in civilian markets.

Although many operations within this broad range are easily convertible, some have few or no apparent civilian applications. A number of facilities may simply have to be closed down because they are too military-specific, too contaminated, or too costly to convert, in which case a diversification approach is most sensible. Beyond the directly military-related operations there are what economists refer to as "indirect effects" (industries supplying goods and services to prime contractors) and "multiplier effects" (economic activity and employment sustained by purchases made by military industry employees and members of the armed forces). In those cases, the problem is often not one of converting operations, but rather of identifying alternative market demand.

Information on the military sector made available by most governments is not detailed enough in geographical, sectoral, and occupational terms for a reliable assessment of conversion's problems and promises. The United States, at the end of the spectrum, publishes a fairly large amount of relevant information. The Soviet Union, notorious for its [illegible]n with military secrets, is still struggling with the demands of [illegible] in this area. But even western countries such as the United

Kingdom and West Germany keep crucial information classified, making it exceedingly difficult to piece together the military industry puzzle. This situation led Paul Quigley of Coventry Alternative Employment Research in Britain to comment:

> The government tells us that thousands of jobs in Britain depend on military contracts...but deliberately fails to give us sufficient information to be able to determine where those jobs are. Defence industry employees are sometimes referred to as "economic hostages" because their political representatives are told by the military establishments to support more defence spending or their constituents will lose their jobs. If we think of defence industry employees in this way then the government policy of withholding information makes sense. No hostage taker is anxious to reveal the whereabouts of the hostages, let alone information about how to release them![16]

Nevertheless, enough information is publicly available to sketch a rough picture of the military economy on the global and national levels. Worldwide, the military sector absorbs between one-quarter and one-third of all R&D expenditures, capital investments, and working scientists and engineers. For most nations, the armed forces employ far more people than the production of arms does (see Table 1), though the skill levels of those employed in the military industry tend to be far higher than those of soldiers.[17]

National averages understate the dependence of individual regions and communities on defense spending. The military industry is not only geographically concentrated, it is also heavily oriented toward a handful of industrial sectors—principally electronics, aerospace, and shipbuilding—and disproportionately reliant on engineers, scientists, and managers. Thus what seems negligible on the aggregated national level may pose grave adjustment problems during disarmament.

In the United States, California received 17 percent of all Pentagon spending in fiscal year 1988, followed by the states of Virginia, Texas, Florida, and New York. Almost 40 percent of military procurement contracts go to just a dozen metropolitan areas. A more telling picture of regional defense dependency emerges, however, by measuring the

Table 1: Armed Forces and Employment in Military Industry, Selected Countries

Country	Mil. Ind. Employees[1]	Armed Forces[2]	Total	Military Industry as Share of Ind. Employment[3]
		(thousand)		(percent)
Soviet Union	4,800	3,993	8,793	12.6
China	5,000	3,530	8,530	10.0
United States	3,350	2,212	5,562	14.4
India	280	1,502	1,782	3.5
United Kingdom	620	328	948	9.8
France	300	559	859	5.6
Poland	260	441	701	5.2
West Germany	190	495	685	2.2
Italy	124	531	655	2.5
Brazil	75	541	616	1.0
Egypt	100	450	550	5.5
Spain	66	314	380	2.6
Czechoslovakia	125	215	340	4.4
Israel	90	180	270	27.7
Greece	9[4]	203	212	1.2
South Africa	100	102	202	n.a.
Canada	89	86	175	3.9
Belgium	33	109	142	3.7
Netherlands	29	106	135	2.8
Sweden	28	66	94	2.7
Australia	15[4]	70	85	1.1
Austria	16	39	55	1.8
Norway	15	38	53	3.7
Switzerland	23	20	43	2.3
Finland	5	37	42	0.8
13 developing countries[5]	333	4,509	4,842	1.0
Total Sample	16,075	20,676	36,751	8.0
WORLD TOTAL	n.a.	29,743	n.a.	n.a.

[1]Employed in arms-producing industries, various years. These figures are to be treated with caution; in most cases, they represent only rough estimates.
[2]Military personnel employed by national defense ministries, 1987. Soviet figure reflects official data, as of January 1990.
[3]Employment in military industry measured against total employment in mining, manufacturing, gas, electricity, and water industries.
[4]Employment in public sector only.
[5]Turkey, North and South Korea, Pakistan, Taiwan, Indonesia, Thailand, Argentina, Philippines, Peru, Chile, Malaysia, and Singapore.

Sources: Arms production employment based on compilation by Worldwatch Institute; armed forces from U.S. Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers 1988* (Washington, D.C.: U.S. Government Printing Office, 1989), and from "Soviets Say Cutback in Military Spending Will be 8.2% in '90," *New York Times*, December 16, 1989; total industrial employment from *Statistical Yearbook 1985/86* (New York: United Nations, 1988), Table 20.

share of a state's output of goods and services that goes to the military sector.[18] (See Map 1.)

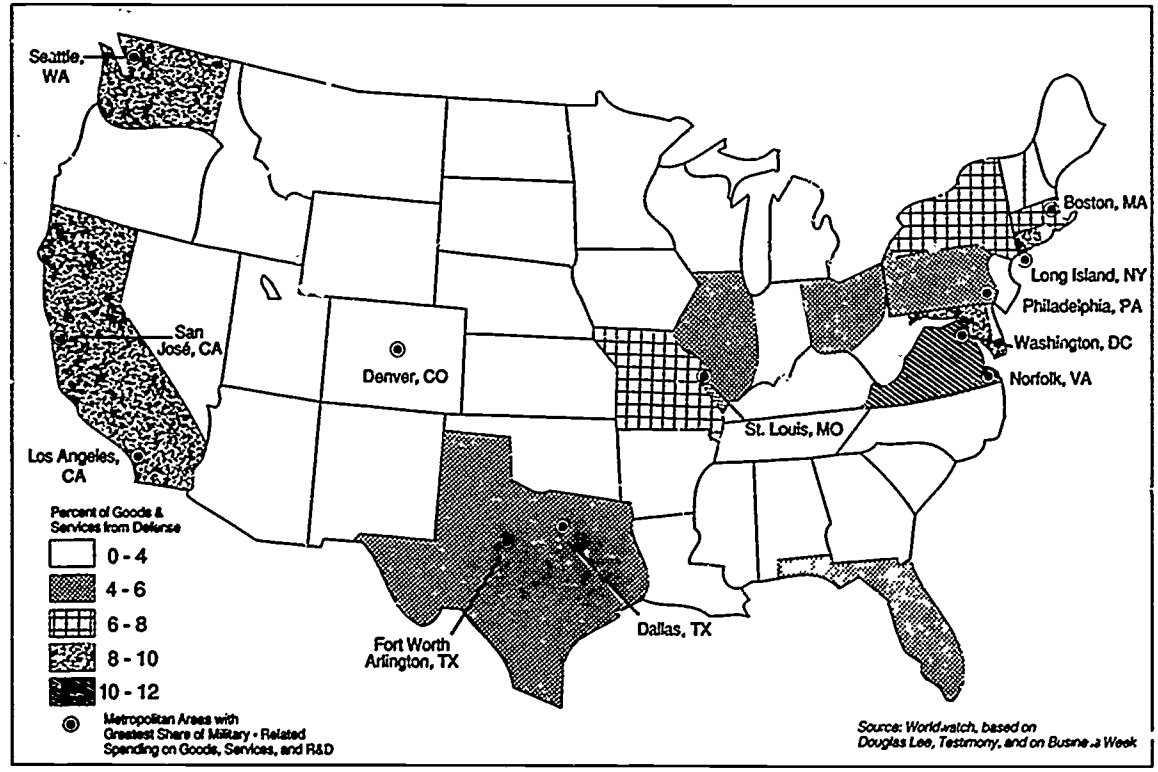
14 Data for other countries are far less detailed and up to date. The regional distribution of military expenditure in the United Kingdom is highly lopsided, with 43 percent going to the Southeast and another 16 percent to the Southwest. In Italy, over 80 percent of military industry employment is found in just 5 of 20 regions, with the highest degree of dependence in Liguria and Campania. Almost 40 percent of jobs in the French arms industry are concentrated in the Ile-de-France surrounding Paris; relative to all industrial employment, military industry also plays an important role in the Bretagne and in the southwestern and southeastern parts of the country. In Belgium, the southern region of Wallonia accounts for a disproportionate share of arms production and employment. In West Germany, the southern states of Bavaria and Baden-Württemberg receive a large share of military procurement orders, but the northern cities of Bremen, Kiel, and Hamburg are relatively more dependent on such contracts.[19]

Much less is known about the Soviet situation, but a sample of 100 arms-producing enterprises assembled by Julian Cooper of the University of Birmingham revealed that almost all are located within the Russian republic, particularly in the Urals, in the central economic region around Moscow, in the Volga region, and around Leningrad.[20]

Disarmament is most likely to precipitate economic adjustment problems in these regions, so alternative use planning is most needed here. The actual savings and employment effects depend strongly on the specifics of future arms agreements, particularly the extent to which they constrain arms production, the way governments tailor their armed forces to comply with any accords, and the speed with which the measures are implemented. Arms control treaties usually set limits on the numbers of certain kinds of weapons that can be deployed. With the exception of the Intermediate-Range Nuclear Forces (INF) Treaty, they have not placed any direct constraints on the production of weapons themselves.

Still, fewer production workers will be needed to the extent that limits

Map 1: Defense as Share of Total Output of Goods and Services per State



on deployment inherently lead to shorter production runs. On the other hand, the lack of curbs to a qualitative arms race may make it difficult to cut the number of scientists and engineers. The withdrawal and scrapping of already deployed weapons will release relatively few resources, although maintenance and operating costs for modern weapons systems are far from negligible. Costs arising out of the physical destruction of arms, verification measures, and, in many cases, environmental cleanups may take a substantial bite out of any savings. The demobilization of troops, on the other hand, makes labor and skills available.[21]

A few estimates have been made of the potential monetary savings from future arms agreements, but little parallel work has been done yet on the impact of arms treaties on jobs. Annual U.S. savings from a START treaty, for instance, could be as high as $14 billion during the decade ahead if currently planned modernization programs are shelved. (They could be as low as $7 billion if these programs proceed.) Reduced warhead production and operations costs could bring in an additional $3–5 billion. The Soviet Union, meanwhile, might save as much as $11 billion per year.[22]

It is virtually certain that the superpowers' conventional forces in Europe will be trimmed during the nineties. At the moment, proposals have been made to reduce U.S. and Soviet troops to 225,000 and 195,000, respectively, down from today's levels of 305,000 and 565,000. Since NATO will have to make cuts of only 10–15 percent in its combat equipment under a conventional arms accord now being negotiated, it will derive considerably fewer savings than the Warsaw Pact nations will, as they have to slash their hardware by roughly 50 percent. Current proposals might save the United States an annual average of $8 billion, rising from $1.5 billion in 1991 to $18.9 billion by 1995. While putting any number on potential Soviet savings is a haphazard undertaking, one estimate suggests an annual average of $36 billion.[23]

Overcoming Barriers, Dispelling Myths

The major barriers to conversion are not technical but political, ranging from the power and agendas of vested interests to the widespread mis-

"Without a convincing economic alternative, military industry employees see disarmament as a threat to their livelihoods."

conception that military spending makes good economic sense and that disarmament will set off a depression.

Military contractors have little incentive to move out of defense work. They enjoy low-risk operations, often generous cost-plus contracts, and hence large profits. They also operate without having to invest much of their own capital. For such companies, conversion can mean a loss of power and privilege. A 1985 U.S. Department of Defense study of military contractor profitability, the *Defense Financial and Investment Review*, found that for 1970–83 military profits as a share of assets (at 20.5 percent) were far ahead of civilian profits (13.3 percent). This finding is confirmed by a similar Department of the Navy study and by data from the U.S. Census Bureau. By all indications, the situation in other major arms-producing countries is comparable.[24]

Other less quantifiable but equally serious reasons stop management from considering conversion. Economists Lloyd Dumas and Suzanne Gordon observe that it "is seen as a fundamental challenge to management's important prerogatives—the ability to shut down operations whenever and wherever it desires and to produce whatever it wants, whenever, wherever, and however it wants." Indeed, according to Jonathan Feldman of the National Commission for Economic Conversion and Disarmament, "in the past, top military managers have resisted planning for conversion to the point that they have sacrificed facilities to permanent closure rather than propose their reuse for civilian purposes through conversion."[25]

Without a convincing economic alternative to defense jobs, military industry employees see disarmament as a threat to their livelihoods. Many engineers are reluctant to transfer to civilian jobs, which tend to be less well paid and involve less exotic technologies. This distinction is not so pronounced for the average defense production worker. But so long as military orders are received and employment appears secure, most workers are apparently willing to stick with arms production.

In the Soviet Union, too, military industry managers complain about limits to their privileged access to skilled labor, financial resources, and materials due to the effort to put the defense establishment on a

self-financing basis and to introduce *khozraschet* (economic accountability). Remaining in the military orbit has become less attractive. According to Alexei Izyumov, a Senior Associate at the Institute of USA and Canada in Moscow, a growing number of leaders of military institutes and enterprises seem increasingly prepared to give up their privileges in return for greater independence in decision making. Likewise, the military sector has lost much of its earlier attraction for the nonmanagerial work force. During the past few years, virtually all the superior wage-and-fringe benefits have evaporated for the rank and file, while the negative aspects of military industry employment—rigid work discipline, overtime, unhealthy working conditions, stricter quality inspection, and limitations on travel abroad for security reasons—have remained in place.[26]

National defense establishments are predictably hostile to the prospect of genuine conversion planning because it would jeopardize their command over a sizable portion of society's resources and, thus, a good measure of political power. In western countries, the politics of the military pork barrel not only provides defense establishments with a lever to press for continued high military spending, it is a serious impediment to a conversion program: every military dependent community represents a formidable constituency for maintaining the status quo. In the United States, for example, the Pentagon and its contractors have deliberately spread military work across as many congressional districts as possible, as a hedge against Representatives and Senators opposing controversial weapons projects. Numerous obsolete military bases have been kept in operation for similar reasons.[27]

The myth of military-led prosperity remains a major obstacle to conversion. This conviction that it is possible to have both guns and butter in unlimited quantity is rooted in the U.S. experience of the forties, when war spending pulled the economy out of the Depression. Although the demand generated by military outlays may have given the economy a quick shot in the arm then, decades of continued heavy military spending during the cold war have had an altogether different and deleterious impact. They have contributed to a lag in U.S. civilian investment, productivity, and competitiveness. Even the much hailed military pork barrel turns out to be empty for most communities. A recent study by

"Every military-dependent community represents a formidable constituency for maintaining the status quo."

Employment Research Associates found that 321 out of the 435 U.S. congressional districts in effect pay a "net Pentagon tax": they lose more in defense-obligated federal taxes than is returned to them in military salaries and contract money. The winners are mostly concentrated along coastal and southern states, in what has been dubbed the "gun belt."[28]

Military spending has long been touted as an ideal job creation program. But experience in the United States and elsewhere demonstrates that military-related employment rises and falls with the government procurement cycle and the vagaries of international relations. (See Figure 1.) During the Carter-Reagan buildup between 1976 and 1987, jobs in the military industry doubled to almost 3.4 million—a postwar level surpassed only during the conflict in Korea. Strong budgetary pressures, however, have already caused a decline from 1987's peak and, combined with the fading of the cold war, portend a severe retrenchment in the years ahead.[29]

Arms production is steadily becoming more capital-intensive, reducing the number of jobs that can be generated with a given amount of money. In the United Kingdom, for example, military industrial employment declined 25 percent between 1963 and 1978 (from 963,000 to 715,000), while defense spending rose 11 percent in real terms. And even though the early eighties brought a major rearmament program, jobs created by military outlays fell by a further 10,000 between 1978 and 1986. In Italy, the aerospace industry's output grew at an astounding average annual rate of 18 percent between 1980 and 1984, yet employment in the sector rose only 1.2 percent a year.[30]

Dollar for dollar, most civilian spending creates more jobs than military outlays do because it tends to be less capital-intensive. U.S. Bureau of Labor Statistics data show that 85¢ of every dollar invested in education and health care goes to job creation, compared with 34¢ in the case of military contracting. Put differently, spending $1 billion (in 1989 dollars) on guided missile production creates about 12,100 jobs; when producing military aircraft, it creates 18,800 jobs. But spending the same amount on air, water, and solid waste pollution control equipment will yield 22,200 jobs; on local transit, 28,900 jobs; and on educational

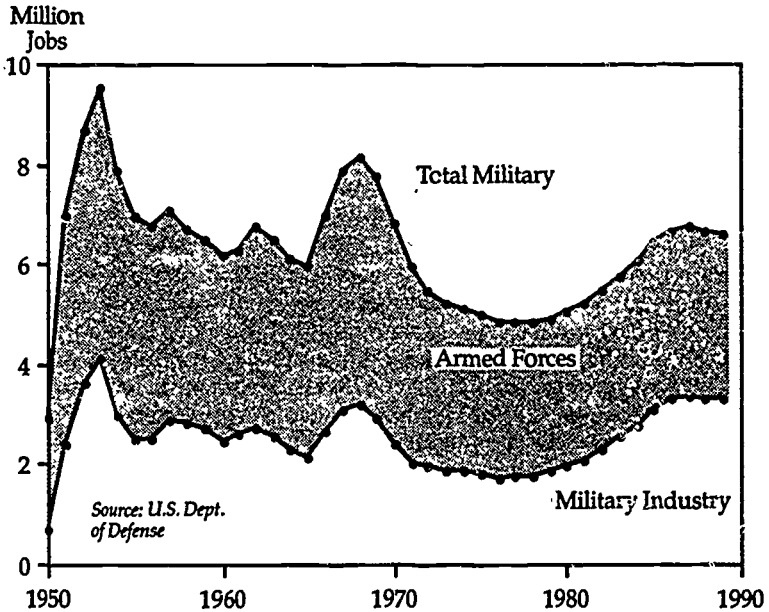


Figure 1: Employment in the U.S. Military Sector, 1950–89

services, 84,700 jobs. In West Germany, 1 billion deutsche marks ($607 million at 1989 exchange rates) saved in the military budget and spent on alternative programs would create at least 800, and possibly up to 6,500, more jobs than would be lost in the military sector.[31]

Because the level of capital intensity does vary considerably within both military and civilian-oriented industries, the job creation potential of conversion depends on the mix of activities supported with money saved from the military budget. Furthermore, while civilian programs offer greater overall employment opportunities, it is not clear how skills now found in the military economy will match those needed in a peace economy. For example, transferring money from weapons development to health care will be a boon to the medical profession but will hurt electrical engineers. The imbalance may be even more pronounced

at regional or community levels. A conversion policy needs to grapple with these difficult questions. Retraining can address some of the inherent problems, but certain military-related skills will simply not be needed in a peace economy.

Building a Conversion Coalition

Although the political obstacles to conversion are formidable, a coalition for building a peaceful economy could change the equation. Grassroots conversion campaigns span a broad spectrum of efforts: worker-initiated groups concerned not only with job maintenance but also with the production of socially useful goods and greater worker participation in decision making; activists and self-help groups that highlight the need to change budgetary priorities in favor of social programs, public infrastructure, inner-city development, and the environment; religious, peace, and Third World solidarity groups opposing arms production for export; academics concerned with the deleterious effects of large-scale military spending on the civilian economy. Conversion is a theme around which various social change movements might coalesce.

Given political will, a changeover from military to civilian purposes can probably be accomplished in a top-down manner without much popular involvement, as the experiences in China and the Soviet Union illustrate (described in the next section). But conceptually, conversion goes beyond a mere reshuffling of people and money to encompass a degree of economic democracy and public accountability that few if any countries have realized to date.

Several major trade unions in Western Europe and the United States have explicitly linked conversion planning proposals with ambitious demands for more workplace democracy. Plant-based alternative use committees would greatly augment worker involvement in decisions concerning investment and production, plant closings, automation, and layoffs. Alternative use planning offers a chance to examine the direction of technological development, the scale and capital intensity of production technologies, and occupational health and safety. The unions

have come to regard the planning mechanisms central to the conversion concept as generally useful in efforts to soften or avoid the social and economic dislocations resulting from wrenching structural transformations in the civilian sphere.

The question "conversion to what?" implies more than just a simple-minded shift from all things military to all things civilian. An indiscriminate approach may only exacerbate existing civilian overcapacities and deepen structural unemployment problems. Civilian shipbuilding, for example, does not offer a viable alternative to producing warships and attack submarines. Indeed, conversion is very much concerned with the *kind* of civilian economy to emerge. An inherent goal is the production of socially useful goods to satisfy unmet needs in housing, health care, energy, environmental protection, transportation, and education. This implies a more differentiated approach than the open-ended pursuit of economic growth.[32]

By releasing resources now absorbed by the military, conversion can make an important contribution to the social and economic revitalization of urban areas, particularly benefiting disadvantaged inner-city residents. The Congressional Budget Office has estimated that the United States is $15 billion short of its spending needs on transportation, infrastructure, and water treatment every year. Yet the ability of U.S. cities to address mounting social problems suffered a tremendous decline between 1978 and 1983 as federal grant programs dropped 25 percent to $104 billion (in 1989 dollars). A recent study for the U.S. Conference of Mayors concluded that transferring $30 billion annually over five years from military programs to housing, mass transit, education, health care, and community services would increase employment and have other beneficial economic effects.[33]

The financial strength of local governments has weakened significantly in other western nations as well—at a time when much greater expenditures are warranted. Investments by local communities in West Germany, for example, declined by 26 percent between 1980 and 1984, reaching a historic low of 30.5 billion deutsche marks. The German Institute for Urban Studies has estimated that, including environmental considerations, outlays twice the current annual level are required.[34]

"Producing more cars instead of tanks would simply exacerbate the environmental crisis."

In an age of profound ecological crisis, the question "conversion to what?" cannot avoid addressing the neglected relationship between economy and ecology. Producing more cars instead of tanks, for example, would simply exacerbate the environmental crisis. The environmental community could strengthen the alternative use concept by developing guidelines for conversion to a more sustainable economic system founded on environmentally sound products and production technologies. Indeed, noted environmentalists such as Amory Lovins and Barry Commoner have advised worker-initiated conversion groups in the United States and abroad on such matters.[35]

Reduced military spending could release desperately needed funds to clean up the planet. For example, the cost of the Stealth bomber project, some $75 billion, would cover three-quarters of the estimated costs to meet U.S. clean water goals by the year 2000. And about 40 days' worth of global military expenditures would be enough to fund a 20-year United Nations action plan to halt Third World desertification.[36]

More important, the features embedded in the conversion concept can help smooth the transition to a sustainable society by addressing misunderstandings about tension between the goals of full employment and a healthy environment. An ecologically inspired restructuring of the economy would involve a transition from activities that contribute most to global warming, ozone depletion, and other threats to human health and the environment. To be sustainable, an economy must rely more on renewable energy, emphasize conservation and efficiency, minimize waste and hazardous materials generation, maximize recycling, and generally rely on environmentally benign products and production technologies. Oil and coal producers, auto manufacturers, timber companies, and branches of the chemical industry (such as the plastic packaging industry) would unquestionably be among those most affected by such a transformation. Unfortunately, environmental groups have given insufficient attention to the employment and other economic implications of the transition to a sustainable society.

Little work has been done to assess either the impact of such fundamental economic shifts or the potential of "environmental" work opportuni-

Currently, most environmental protection expenditures—and thus

the jobs created—go to mitigate or repair ecological damage. Pollution control outlays have generated an estimated total of 1.4 million jobs in the United States and 1.25 million in the European Community. There is added potential for alternative employment, however, if the focus shifts from "tail-pipe" technologies and remedial actions to a preventive approach—developing new, environmentally more benign products and industrial processes. A key variable is capital-intensity: the number of jobs generated by each dollar spent. A sustainable society must wrestle with this difficult question if it is to provide sufficient employment.[37]

The promise of building a broad coalition around the conversion issue is matched by the difficulty of doing so. Conversion initiatives range from specific local or regional issues to the need for national legislation. Accordingly, they are often initiated by quite diverse groups with different, sometimes conflicting class-backgrounds, motivations, philosophies, constituencies, strategies, and goals. Some see conversion as a tool for social change, but others favor narrower approaches.

On occasion, this can lead to friction. For example, the preoccupation of large segments of the peace movement with the moral dimensions of arms production—leading to demands for the closure of military factories, not conversion—has in the past alienated parts of the labor movement. Plant-based conversion initiatives, on the other hand, are sometimes narrowly concerned with job security while eschewing broader social goals. These have often been ad hoc campaigns, springing to life in response to the threat of layoffs and sometimes ending abruptly when a new military contract is signed. Frequently, conversion is an option of last resort, considered only once the fight to cling to military production has been lost.

Weaving the fabric of a broad, nationwide conversion coalition remains a challenging task. But the threads are gradually coming together. The conversion debate has reached a new threshold: the military expansion of the eighties is over, and the needs of social and economic revitalization and environmental restoration are clear. Many workers are starting to see that they cannot continue to depend on military spending for their livelihoods. And, as the threat of nuclear war recedes, the peace

movement has come to realize that it needs to take the economic aspects of militarism more seriously.

The Paths Forged by China and the Soviet Union

Since the end of World War II, little systematic experience of planned conversion has been gained. Only one major power—the People's Republic of China—has undertaken a large-scale demobilization and conversion effort, though the Soviet Union is now following a similar path. While the Soviet and Chinese cases are important in their own right, as these countries are among the world's leading arms producers, they cannot be considered models easily emulated elsewhere. For one thing, their economies are simply too different from those of other nations. And in both cases the conversion effort is intricately interwoven with an attempt to reform the entire economic system—a task of incomparable magnitude and difficulty. Rather, the significance for the global community of their endeavors lies in the demonstration that conversion is a realistic option, even in a world that has barely begun to consider alternatives to the arms race seriously.

In 1985, the Central Military Commission of China's Communist Party, the supreme decision-making body on military affairs, determined that a major war was highly unlikely for at least the rest of the century and that, consequently, the military apparatus could be trimmed considerably. Landmark though it was, this step merely accelerated a trend begun in the late seventies. Beijing's decision reflected not only an evolution in security thinking, in particular the improved state of Sino-Soviet relations, but also the fact that the economic dimensions of security are being taken more seriously. Although military modernization is important to Beijing, it was nevertheless assigned the lowest priority of the "four modernizations," behind agriculture, industry, and science and technology.[38]

China's conversion endeavor is characterized by strong centralized direction and minimal public accountability; it could, in principle, be reversed again if the leaders' priorities shift. Indeed, since the violent suppression of the pro-democracy movement in June 1989, the decline of

the military's political influence has been reversed. At a time of a general squeeze on the budget and economic austerity, the military budget for 1990 was dramatically increased.[39]

Nevertheless, between the late seventies and the late eighties the size of the People's Liberation Army (PLA) was cut by about 1.2 million, or one-fourth, and military spending, after accounting for inflation, was reduced by one-third. (See Table 2.) Because the Chinese economy has grown quite remarkably, the overall military budget now absorbs only about 4 percent of the gross national product, down from an average of 13 percent during the seventies. Expenditures to procure military equipment have declined by one-fifth, and spending for military construction projects has tumbled by a whopping 44 percent. The country's nuclear weapons program has been spared cost-cutting, however, and outlays for research and development have increased by roughly a quarter, reflecting greater emphasis on streamlining and modernizing the armed forces.[40]

China's modern-day arms industry dates back to the fifties, when the People's Republic pursued a vigorous program of military industrialization with massive support from the Soviet Union. The Sino-Soviet split left Beijing to pursue weapons development on its own. From 1964 until 1979, China spent an estimated 200 billion yuan ($54 billion) to build nearly 30,000 widely dispersed military plants in remote inland regions—the so-called Third Capital Construction Front in the provinces of Henan, Hubei, Hunan, Guizhou, Yunnan, Sichuan, Shaanxi, and Gansu. This effort was apparently of such magnitude that it caused severe dislocations in the Chinese economy.[41]

By the late seventies, just as this enormous project was nearing completion, China was faced with a growing surplus of its military production capacity. Resources devoted to a bloated but increasingly obsolete military sector drained the civilian economy of needed investments. While military factories were underused, the government was hard-pressed to satisfy people's growing thirst for consumer goods. Though no reliable figures are available, it is believed that 10 percent of China's industrial output is of a military nature, and much of that represents the country's most modern production capacity. For example, half to three-quarters

Table 2: China's Armed Forces and Military Expenditures, 1970–87

Year	Military Spending[1] (billion 1989 dollars)	Armed Forces (million)
1970	23.5	2.85
1975	26.7	4.30
1979	31.5	4.60
1980	27.8	4.65
1981	27.1	4.75
1982	27.3	4.35
1983	27.3	4.10
1984	27.9	4.10
1985	28.0	4.10
1986	22.2	4.03
1987	22.2	3.53

[1]Military outlays in mid-eighties include demobilization costs.

Source: U.S. Arms Control and Disarmement Agency, *World Military Expenditures and Arms Transfers* (Washington, D.C.: U.S. Government Printing Office, various editions). Military spending data translated into 1989 dollars by author.

of the electronics industry's output is absorbed by the military sector.[42]

In the late seventies, the Chinese leadership decided to launch an ambitious conversion effort. Military factories were made responsible for their own profits and losses. While they were forced to reorient production toward civilian markets (because orders from the military declined), no central government plan assigned individual facilities to produce any particular goods in any specific quantities. Hua Di, an official of the China International Trust and Investment Corporation, said in a recent interview that "there was just an overall appeal to defense industry managers to help reduce the burden of consumer goods shortages." This was an enormous challenge to enterprises accustomed to the allocation of ample funds and raw materials by the state and to preferential government treatment and a guaranteed market. The blow was

softened, though, by making preferential tax and credit terms available for converted factories.[43]

28 The share of military factories' output devoted to the civilian market doubled between 1978 and 1983, to one-fifth; it has now passed the 60 percent mark and is expected to reach 70 percent this year. China's military industry today manufactures nearly 400 different consumer items, from bicycles and cars to medical instruments, textile machinery, television sets, and washing machines. Facilities were put into three categories: those producing exclusively for the military (about 10 percent of the total); those producing both military and civilian goods (73 percent); and those converting entirely to civilian purposes (17 percent). Thus some enterprises have undergone a conversion process, while others' experience may more aptly be described as diversification.[44]

Military factories that had been built on purpose in remote and often inaccessible inland locations pose a special problem, because most are far removed from any large-sized civilian markets. Yet the Third Front region is an important economic factor: it accounted for roughly half of China's total arms production in the early eighties and for one-quarter of its overall industrial production. The government made 2 billion yuan ($540 million) available to relocate 100 factories to nearby small or medium-sized cities.[45]

The conversion effort reaches beyond the arms-producing facilities. Some 59 airfields, 29 docks, 300 railway lines, and 30 telecommunications lines used exclusively by the military have been opened for local civilian economic development. In addition, all army hospitals are now accessible to civilian patients.[46]

China's conversion undertaking has not been an unqualified success. Among the plants controlled by the Aeronautics and Astronautics Ministry, one-third have failed to produce any marketable civilian products, and another third have been too inefficient to compete in the civilian arena. Generally, though, the converted facilities have encountered few problems so far in marketing their new products, partly because the quality tends to be higher than that of goods produced by civilian factories. But military enterprises often do not recoup the full production

"China's military industry today manufactures nearly 400 different consumer items."

costs: their goods are priced comparable to civilian-sector goods, yet they rely on more expensive inputs. Demand for consumer goods has been enormous, but now some markets are becoming saturated, which may provide a tougher test of how successfully military firms have adapted to the civilian market.[47]

The scaling-down of the Chinese armed forces came at a time when unemployment re-emerged in serious proportions for the first time since the mid-fifties. Some officers discharged from the PLA were encouraged to retire with relatively generous pensions. Others were transferred to civilian government posts. Since there are no western-style labor markets, China has relied on administrative methods to provide alternative employment opportunities. The government has generally sought to resettle demobilized personnel in their home towns, where they can rely on families to smooth the reintegration process. Some 80 percent of soldiers are from rural, agricultural communities. Local authorities were required to set up agencies to assist with job and housing needs. By offering higher salaries, better housing, and other amenities, the government has also tried to encourage former soldiers to relocate to the most remote areas of China, in order to help in regional economic development.[48]

Urban civilian enterprises were generally reluctant to hire ex-soldiers because most received only infantry training and political education, and they lack essential production and management knowledge. To address this problem, the PLA and local authorities offer retraining courses in such civilian skills as agronomy and forestry, carpentry, brick-laying, plumbing, mechanics and electrical work, architectural design, and economic management. Chinese officials say these training programs have greatly improved the "marketability" of ex-soldiers. Yet in labor-glutted urban areas, ex-soldiers still have problems finding work. The *Far Eastern Economic Review*, for example, reports that "more than 20 percent of demobilized soldiers with civilian skills in Shanghai were unemployed in 1987."[49]

Regarding the factories themselves, the aim has been to create a dual-use capacity rather than completely switching from military production, with factories able to churn out war matériel when needed. The

conversion policy was also in part brought about by a growing realization that the prospect for modernizing the armed forces depends on China's overall economic and technological development—as reflected in the official slogan "using civilian production to support military production." Indeed, a portion of the income generated by civilian production in military factories is used to supplement the military budget rather than being reinvested for civilian purposes. The *Economist* reported in 1988 that "as much as half of the [PLA's] research and development budget may be financed by profits from such work."[50]

Aside from producing civilian consumer goods, China's military factories have pursued a lucrative sideline business that could derail conversion: arms exports. Production for export could "crowd out" civilian products or relegate conversion to the obsolete portions of the military industry. Since 1977, economic self-interest and financial requirements have replaced political and ideological preferences as the guiding principle in the nation's weapons export policy. Revenues from this source now help finance the acquisition of foreign military technology. Foreign sales account for an estimated 20 percent of military production and 6 percent of the country's total exports. From an average of 2 percent in the seventies, China increased its share of the global arms export market to about 4 percent in the second half of the eighties. (Earnings from weapons sales abroad did drop sharply in 1989, however, due primarily to the end of the Iran-Iraq war).[51]

Despite these shortcomings, China has taken a bold step worth following elsewhere. Although the particulars of this experiment may not be of much practical relevance to countries with vastly different societies, the general idea is what counts. Measured by its own yardstick, China's conversion undertaking has been fairly successful.

The Soviet Union, too, is beginning to tackle conversion in an effort to lighten the military burden on its economy. Just how heavy that burden really is remains difficult to assess, even in the heady days of *glasnost*. Back in the early eighties, an estimated one-fifth of total industrial output was absorbed by the arms sector, including one-third of the machine tool and metal-working industry and two-thirds of aircraft and shipbuilding.[52]

President Gorbachev's foreign and military policies have so far yielded more political than economic dividends. Still, the INF Treaty signed with the United States brought a one-time net savings of 300 million rubles ($465 million, at the current official rate). This is a small amount, but it would be enough to build 30,000–40,000 apartments, for example, which could help alleviate an acute housing shortage.[53]

Factories that used to produce missiles now proscribed by the INF accord have shifted part of their capacity to civilian production. The Votkinsk machine tool plant in the Udmurt Autonomous Republic, the Petropavlovsk facility in Kazakhstan, and a factory in Volgagrad are now churning out metal-cutting machines, drilling rigs and other oil industry equipment, washing machines, bicycles, and even baby carriages. Meanwhile, Kranlod—a Soviet-West German venture in Odessa—has begun to transform several hundred SS-20 missile launchers into self-propelled hoisting cranes. Some missile design laboratories have also been reoriented toward civilian work, including the development of a meteorological carrier rocket for the State Committee for Hydrometeorology.[54]

The major unilateral troop and tank cuts announced by President Gorbachev in December 1988 created an additional practical need for conversion. Negotiations about Conventional Forces in Europe (CFE) will result in further substantial reductions. Even while the CFE talks are under way, Gorbachev has agreed to limit Soviet troops stationed in Europe to 195,000 and to withdraw all forces currently stationed in Czechoslovakia and Hungary; he also indicated readiness to negotiate a similar pullout from Poland. Troops in East Germany may not remain long, either.[55]

The Ministry of Defense and the State Committee for Labor have jointly established a retraining program to smooth the transition of discharged soldiers to civilian life. Still, the provisions for housing, feeding, and employing decommissioned officers and their families may fall short of the needs. Even before the current cuts, more than 20,000 officers' families had no permanent housing, yet the Defense Ministry will be able to provide no more than 7,500 apartments during 1990–91. With additional troop withdrawals on the horizon, the ranks of the demobilized will

number in the hundreds of thousands in coming years. In the short term, demilitarization could cause considerable problems, but if it is handled well the ex-soldiers will be an economic plus over the long run in an economy chronically short of labor.[56]

Independent of arms control negotiations, the Soviet leadership decided to slash arms output unilaterally by 19.5 percent between 1988 and 1990. Between 1991 and 1995, the production of tanks will be cut 52 percent, of military aircraft 12 percent, of helicopters 60 percent, and of ammunition 20 percent. Military spending, frozen in 1987–88, is to be reduced by 14.2 percent or 10 billion rubles ($15.5 billion) by 1991. Most important, the military R&D budget will not be spared: specifically, in 1989 the Politburo discussed a proposal to cut aerospace R&D in each of the next three years. Prime Minister Ryzhkov hopes to trim defense expenditures further over the next six years, by at least a third and maybe by one-half.[57]

Channeling these savings into civilian areas could do wonders: a 10-billion-ruble infusion would allow a 30-percent increase in housing construction; if invested in environmental protection, it would more than quintuple current outlays. An obvious target for Soviet conversion is to alleviate the enormous shortage of quality consumer goods. Plenty of other claimants for the peace dividend exist. One-third of all schools have no running water, for example, and 40 percent lack plumbing; in terms of infant mortality and life expectancy, the Soviet Union is closer to being a developing nation than its status as a military superpower would suggest. But a good share of the expected savings will probably go toward reducing the government's enormous budget deficit.[58]

The stage is thus set for an ambitious conversion program. Throughout the Soviet Union, hundreds of enterprises previously devoted to producing equipment for the military have been instructed to reorient themselves toward greater production of consumer goods. Apparently, some 25 billion rubles are to be made available out of the military budget to facilitate the switchover. However, increased civilian production is not paralleled by greater civilian control: converted factories remain under the jurisdiction of the defense bureaucracy.[59]

"The Soviet leadership decided to slash arms output unilaterally by 19.5 percent between 1988 and 1990."

Military industries already make an important contribution to the manufacture of a wide range of civilian goods. (See Table 3.) According to plans approved by the Council of Ministers in October 1989, the share of military plants' output devoted to civilian goods is to be increased from the current 40 percent to 50 percent in 1991 and over 60 percent by 1995. As an incentive, the Council decreed in September 1988 that defense factories could retain profits from above-plan production of consumer goods during 1989 and 1990.[60]

For example, nearly half the 37 billion rubles ($57 billion) worth of planned new equipment deliveries to the food industry under the

Table 3: Share of Total Soviet Output of Selected Civilian Goods Produced by Military Industry Enterprises, 1965–88

Civilian Product	1965	1975	1985	1988
		(percent)		
TVs, radios, VCRs, cameras	100	100	100	100
Sewing machines	n.a.	n.a.	100[1]	100
Tape recorders	95	95	95	98
Vacuum cleaners	49	46	75[1]	77
Washing machines	41	32	27	69
Motorcycles and scooters	73	68	63	61
Tramcars	72	65	60[2]	n.a.
Refrigerators	48	48	48[2]	n.a.
Bicycles	44	39	40	45
Watches	12	11	19	22
Tractors	13	14	15	n.a.
Metal-cutting machine tools	14[3]	14	13	n.a.
Passenger cars	11[3]	10	12	n.a.

[1]1987. [2]1980. [3]1970.

Sources: Julian M. Cooper, "The Scale of Output of Civilian Products by Enterprises of the Soviet Defence Industry," *CREES Discussion Paper*, University of Birmingham, 1988 (for 1965–85 data); John Tedstrom, "Is the Contribution of the Defense Complex to Civilian Production Growing?" *Report on the USSR*, June 16, 1989 (for 1987–88 data).

investment plan for 1988–95 are to be provided by defense industry enterprises. The plan entails construction of 20,000 new food processing plants and the renovation of twice as many older facilities. The military sector has also been directed to produce 7–8 billion rubles ($10.8–12.4 billion) worth of goods for light industry, as well as to increase output of construction materials, medical equipment, and plumbing supplies.[61]

If previous experience is any guide, however, simply increasing the civilian share of military industrial output without proper reorientation is likely to bring both price and quality problems. Earlier Soviet conversion attempts turned out washing machines that cost twice as much as those produced under a civilian ministry and television sets that exploded and caught fire in people's apartments. Similar problems exist today. The military aviation industry's shift to food production, for example, has essentially been improvised, without much prior study of capabilities and markets. In January 1989, Deputy Prime Minister Igor Belusov conceded that "involvement of the defense industry in technical renovation of food processing is not going as smoothly as could be desired." And Leonid Vid, the deputy chairman of Gosplan, the State Planning Committee, recently admitted that "the high cost of goods produced at defense plants is one of the negative aspects of conversion."[62]

Alternative civilian products selected so far have not always been a good match for the resources of the factories targeted for conversion. Of 585 consumer goods to be manufactured in 1988–89 by all military factories, only 126 were successfully produced. The target for 1989–90—some 126 products—was more realistic, but by the end of 1989 only 23 of these were actually being made. Part of the reason is that the central bureaucracy still retains a strong say in what items individual military enterprises should produce—often without taking local conditions and capabilities properly into account.[63]

Another dimension makes the Soviet conversion problem dramatically different from that in western countries. The country's civilian economy shares many of the detrimental features of its military economy due to decades of rigid centralism. Thus a simple transfer of resources to the

"The success of conversion is inextricably linked to the fate of Gorbachev's *perestroika*."

civilian sector will not solve the problem. Instead, Soviet leaders have decided to enlist the services of the defense industry—with its superior access to skilled labor, materials, equipment, and technologies—in the hopes of a more rapid improvement in living standards than overhauling civilian industry would accomplish. The military sector has been instructed to take some (i.e., the least efficient) civilian plants under its wings to improve their performance. The civilian Ministry of Machine-Building for the Light and Food Industries, for instance, was disbanded in March 1988 and many of its 260 enterprises were transferred to the jurisdiction of the defense industry.[64]

Many Soviet analysts agree that the lack of military *glasnost is* a serious obstacle to successful conversion. According to Sergei Blagovolin, an economist writing in *Moscow News*, no reliable data exist yet on the number of military enterprises, the number and skills of people employed at them, the quantity and characteristics of the equipment, or the raw materials and supplies used in arms manufacturing. It even remains unclear to what extent civilian state planning agencies now have access to relevant data and whether the Supreme Soviet oversees the military planning process.[65]

The potentially most serious impediment is the lack of any adequate system to account for the enormous resources devoted to military purposes. As British MP Paddy Ashdown put it recently, "The army simply said what it wanted and industry supplied it. There were no overall budget limits, no effective costings system, and only the most rudimentary methods of cost control." The success of conversion is inextricably linked to the fate of Gorbachev's *perestroika*, the restructuring of the entire Soviet economy. Only with a meaningful set of costs and prices rather than an arbitrary, bureaucratic system can a realistic program be drawn up: reliable indicators are needed to assess both the military's real drain on the economy and the possibilities for converting to civilian use. Without such information, it may be impossible to decide whether to convert a given facility or to close it and start from scratch, not to mention determining whether any conversion undertaking has been successful.[66]

e, Soviet conversion has proceeded on an ad hoc basis. For exam-

ple, the recent decision to slash the volume of arms production came out of the blue, giving military factory managers little notice. To move beyond this haphazard stage, a National Commission to Promote Conversion has been formed, along with working groups within Gosplan and various military-related ministries, to design a proper long-term program and coordinate activities of different institutions. Several governmental institutes are researching the issue. A draft economic conversion law has been submitted to the Supreme Soviet that, among other things, would provide a two-year allowance and a job information system for military workers who lose their jobs. Although current conversion plans are directed from the top, there is growing public discussion and appreciation of the concept, and Soviet conversion proponents are seeking to share insights with their counterparts abroad.[67]

Even though the Soviet Union and China are becoming less centralized, their economies—indeed their societies—have few parallels elsewhere. Thus, few practical lessons for the West can be gleaned from these conversion experiences. China's practice of assigning jobs to demobilized soldiers, for example, is incompatible with European or North American labor markets, with their mix of individual preference and lack of any job guarantees. Further, no private contractors trying to make a profit stand in the way of conversion in China and the Soviet Union.

A strong government role virtually assures that conversion will be implemented once leaders are fully committed. By the same token, however, the lack of public accountability provides little guarantee that any change of course will be maintained. Yet another crucial distinction is that China and the Soviet Union have targeted their conversion endeavors at boosting the meager supply of consumer goods. In western countries, such a strategy would be bound to fail due to increasing saturation and overcapacities; instead, market niches have to be identified, and socially useful but neglected goods must be given greater priority.

Upheaval in Eastern Europe

Relatively little is known yet in the West about the military industries of Eastern Europe and their plans for conversion. But the revolutionary

"Hungary intends to reduce its conventional armaments by 35 percent by 1991."

changes in these nations have greatly accelerated their moves toward disarmament. In trying to adapt military sectors to civilian markets, these countries are likely to grapple with some of the same problems the Soviet Union has encountered. After four decades in Moscow's orbit, they not only share fundamental economic characteristics but rely to a considerable extent on Soviet technology and have adopted the peculiar Soviet military procurement system. Yet their military industries are much smaller and less specialized. And they are now moving more rapidly toward market mechanisms than the Soviet Union is. Whether this proves to be an advantage for conversion remains to be seen.[68]

As members of the Warsaw Pact, the East European countries have been relatively large military spenders (though dwarfed not only by the superpowers but also by such West European powers as France and the United Kingdom). Poland's military sector is roughly comparable in size to Italy's, and Czechoslovakia's to those of Belgium and the Netherlands combined. But Poland and Czechoslovakia are among the world's 10 leading arms exporters. Selling military hardware abroad is important for their economies. Arms accounted for about 4 percent of Czechoslovakia's total exports in 1987 and almost 7 percent of Poland's—proportions surpassed only by Israel, North Korea, the Soviet Union, and the United States.[69]

Virtually all East European nations announced cuts in military spending and armed forces in 1989 and 1990. Hungary, for example, intends to reduce its conventional armaments by 35 percent by 1991. These measures, along with expected additional, CFE-mandated reductions and the withdrawal of Soviet troops from the region, provide a dramatic backdrop to conversion.[70]

Czechoslovakia had been planning to reduce military production since 1988, but the new government set forth a more ambitious goal. By 1993, the volume of production is to be cut to about one-quarter the current level. Specifically, the manufacture of tanks, armored personnel vehicles, and missile technology will be phased out completely. Altogether, some 120,000 people will be affected by these changes.[71]

At the same time, arms exports, on which the country's military indus-

try depends for 75 percent of its sales, have declined dramatically. Conversion will become a particularly crucial goal if the new government follows through on its promise to end all arms exports, as announced by Foreign Minister Jiri Dienstbier in January 1990. Some observers have expressed doubts about the extent and durability of the commitment to such a policy, and government representatives indicated that all existing delivery contracts would be honored. Dienstbier's statement was apparently a declaration of intent rather than a policy to be implemented immediately.[72]

For many years, Czech military industry firms had to transfer a large share of their profits to the government. Although this has left them with insufficient capital to undertake conversion measures, the government will lend financial assistance to only 13 out of 111 arms-producing enterprises. There has been no advance conversion planning. The cancellation of military contracts has led to fears of unemployment and to labor unrest. In February 1990, for example, some 2,000 defense workers in the Slovak town of Dubnica went on strike briefly. But so far, no worker-initiated alternative use committees have emerged.[73]

A number of factors may facilitate a transition to nonmilitary production. As the industry is dispersed throughout the country, the burden of adjustment will not fall too heavily on any particular area. Since the seventies, Czechoslovakia has concentrated its arms production in sectors with close links to civilian products, such as trucks and light aircraft. Moreover, no enterprise has ever been completely dependent on arms production. Military firms are already turning out such civilian goods as locomotives, office equipment, and agricultural machinery. And they are now switching over to greater civilian production. In September 1989, for example, the Heavy Engineering Works in Martin—Czechoslovakia's major manufacturer of heavy military equipment—started manufacturing bulldozers in cooperation with West German, French, and Italian firms.[74]

In Poland, with the entire economy in convulsion, adjusting the military sector may seem a minor concern: military production is estimated to account for about 3 percent of the value of total industrial production. Polish arms factories produce civilian and military goods side by side;

in 1988, the civilian share of output was about 30 percent. As in Czechoslovakia, part of the arms industry could probably turn to greater civilian production with relative ease because a good deal of its products (including trucks, earth-moving equipment, helicopters, and radar equipment) can be used for both purposes. Some of the most logical markets, like heavy machinery for agriculture and construction and merchant ships, are limited however. Rather than churning out more equipment, Poland will need to modernize its production. But given the nation's grave economic crisis, conversion is not an easy alternative. Retooling for different kinds of civilian products is going to be costly, and some Polish observers have argued that closing down certain plants may be economically preferable to refashioning them.[75]

Cutbacks in military spending and procurement are now threatening the future of several of the country's 80 major arms factories, which combined employ 260,000 people. Making up for lower domestic orders through expanded exports seems an unlikely option. Recent developments—resulting in much idle capacity and lower wages—have apparently led to increasing tension on the shop floors. At WSK Swidnik, an important helicopter manufacturer with 9,000 employees, workers held a protest strike: a proposed joint venture to produce minitractors with three Italian companies was to use no more than a third of the plant's capacity. (The Defense Ministry insisted the rest retain its arms manufacturing capability.) Labedy Bumar, a factory that produces T-72 tanks, has been forced to look for civilian customers because sales have slumped and the Army is unable to pay in full for tanks delivered. The plant is seeking to diversify into machinery for agriculture and the construction industry. Yet an attempt to switch to mining machinery has been disappointing because Poland's coal mines, facing a financial crisis, cannot afford new equipment.[76]

Compared with Poland and Czechoslovakia, East Germany has a much smaller arms industry. In fact, two-thirds of the country's military equipment is imported. The military share of industrial production was about 1 percent in 1989; employment in this sector encompasses only "a few tens of thousands," according to East German researchers Klaus Engelhardt and Emil Rechtziegler. Military-related production has ed on electronics, optics, small arms, and shipbuilding.[77]

The peaceful revolution in late 1989 and the prospect of imminent unification with West Germany have been disorienting: suddenly there is no "enemy." With morale among East German soldiers sagging, the *Nationale Volksarmee* is in a state of dissolution. Arms production is being cut back, and factories are clamoring to strengthen their civilian production slates. For example, the Gera plant of Carl Zeiss Jena, a leading East German company, decided to convert its production of guidance systems for tanks to specialized optical instruments for medical uses and the semiconductor industry. Any decisions made now may soon be obsolete as the country prepares to be absorbed into a dominant West Germany. The size and characteristics of a unified German army and military industry will depend crucially on whether the nation adopts a neutral stance or chooses to be a member of the western military alliance.[78]

Grassroots Initiatives in the West

In contrast to China and the Warsaw Pact nations, no western government has pursued an active conversion policy thus far. In fact, the West has to a large extent adopted a wait-and-see attitude even on disarmament, preferring to let President Gorbachev make unilateral concessions. Still, the military expansion of the eighties has undoubtedly ended. Western military budgets will decline—but due more to inflation's erosive effect on purchasing power than to deliberate policy decisions. A different course is possible, however. In the United States, for example, even such former high-ranking Pentagon officials as Robert McNamara, Harold Brown, and Lawrence Korb have argued that military spending could safely be halved over the next decade.[79]

Though the military-industrial complex is the example *par excellence* of a state-directed industry, ironically the prevailing laissez-faire philosophy has predisposed government officials to assume that "the market" would take care of any problems adjusting to disarmament. As indicated earlier, however, after serving the needs of the military for a long time, arms contractors are often incapable of operating in a market environment.

Meanwhile, alarmed by the prospect of disarmament, local communities and regional governments that were complacent as long as a mili-

"Much of the impulse for conversion in the West has come from worker-initiated alternative use committees."

tary base or contract provided jobs and income are seeking ways to reduce their vulnerability. Opposition parties, realizing that a major issue is emerging on which they might capitalize, are gearing up to offer alternative concepts.

But much of the impulse for conversion in the West has come from grassroots activists, primarily worker-initiated alternative use committees. Confronted with the threat of layoffs, arms industry workers at a number of companies concluded they could neither rely on management to safeguard their jobs nor wait for governments to act. Because they did not want to lobby for additional military orders, they decided instead to draw up plans to produce alternative civilian goods with existing skills and equipment. The idea of worker-initiated alternative use groups was first sparked by the Lucas Aerospace campaign in the United Kingdom (described later in this section).

Alternative product proposals range from broad conceptual ideas to almost blueprint-like plans. Although the latter has more credibility, it does not necessarily bring success closer: managements are loath to in effect endorse workers' "infringement" of the corporate prerogative to make fundamental product and investment decisions. Thus, alternative use groups realized that they need to mobilize public opinion and generate political pressure both on industry executives to consider civilian alternatives and on governments to become more supportive.

Initiated from below, alternative use working groups were at first perceived by some union officials as an unwelcome attempt to duplicate or bypass established union structures. Most western labor unions have long been on record as opposing the arms race and favoring conversion. Yet little activity backed up official resolutions. For a long time, military industry employment was not an issue in day-to-day activities, and when it arose some shop stewards actually lobbied for arms exports as a means to safeguard jobs. By challenging unions to come to terms with the concept and to develop more specific ideas for implementation, the alternative use working groups became the driving force in the conversion discussion.

ersion is of particular relevance for the United States as the coun-

try struggles to adjust to the priorities of a post–cold war world. If it were a separate entity, the U.S. military sector would be the thirteenth largest economy in the world, just ahead of East Germany. Even though the U.S. military budget has hardly been touched yet, some 140,000 defense industry jobs have been lost in 1986–89. The economic forecasting firm DRI/McGraw-Hill predicts 600,000 jobs will disappear by 1994, and 10–20 percent of those laid off are expected to have skills not easily transferable to civilian uses.[80]

Western Europe's military economy, though considerably smaller than its U.S. counterpart, faces a similar situation: after the tremendous boom of the eighties, overcapacities run high. Perhaps as many as 100,000 jobs were lost in 1987–89, and an equally high number might be lost between 1990 and 1992, as cold war procurement plans are scuttled. If major arms control and disarmament treaties are concluded, as now seems a strong possibility, layoffs will hit both West European and U.S. military economies like an avalanche. In fact, Belgium and Austria—whose arms industries depend primarily on foreign markets—have already seen a dramatic collapse in export sales.[81]

Though governments have adopted a hands-off attitude, conversion has nevertheless long been discussed in the United States, the United Kingdom, West Germany, and Sweden, and is now becoming a topic of intense interest in Italy. Among leading western arms producers, France is the only one that has not addressed the conversion issue, although more than half the weapons manufacturing capacity, most of it state-owned, is idle. Efforts to set up a national conversion commission have been resisted at the highest levels of French government and industry and elicited scant union support. The Belgian trade unions have similarly shown little enthusiasm for conversion; in Austria, most of the activity has taken place outside the factory gates; and in the Netherlands, peace and church groups have been the driving force behind conversion.[82]

In the United States, as it has become clear that the military boom has come to an end, a torrent of activity—hearings, conferences, roundtables, reports, and legislative activities—has been unleashed. Diversification and conversion legislation has either passed or is pend-

"Legislation introduced in California and Vermont encourages conversion into recycling, pollution control, mass transit, and energy efficiency."

ing in a dozen states. The approach ranges from early warning of layoffs to the creation of task forces, donation of technical or financial assistance for affected workers and communities, or provision of incentives for businesses to diversify or be attracted to the area. A bill in Minnesota would require the establishment of alternative use committees and give those companies that implement conversion plans preferential treatment for various state economic development training programs. Legislation introduced in California and Vermont encourages conversion into recycling, pollution control, mass transit, and energy efficiency.[83]

Local and regional studies on the economic impact of military spending and the potential of civilian alternatives have been prepared both by officially appointed task forces and by grassroots groups. Recent reports have dealt with Minnesota, Massachusetts, the Long Island region of New York state, and Washington state. The Long Island report, for example, strongly recommends a focus on environmental protection technologies as a key alternative to military work.[84]

Interest in conversion among U.S. trade unions has been revived by the prospect of large-scale layoffs. The International Association of Machinists and Aerospace Workers (IAM) has a long record of active support for conversion. The International Brotherhood of Electrical Workers, the Oil, Chemical and Atomic Workers, the International Union of Electricians, and the United Auto Workers have all joined the IAM in backing comprehensive national conversion legislation. But the U.S. labor movement remains weak, which may help explain the relatively few examples of shop-floor alternative use initiatives there.[85]

This is bound to change as military spending takes a nosedive. One of the most promising recent campaigns is being waged at UNiSYS in St. Paul, Minnesota. In response to ongoing layoffs at the plant, which produces naval computers, weapon guidance systems, and communications equipment, the International Brotherhood of Electrical Workers began in January 1989 to formulate an alternative use plan. The union conducted a skill audit and gathered over 40 alternative product ideas, as pollution control equipment, energy-efficiency technologies,

and a water-conserving irrigation system. Feasibility and marketing studies are being undertaken with financial assistance of various state public agencies. UNiSYS management has refused to cooperate, but community leaders and top state politicians, including the governor, have been pressuring management on behalf of conversion planning.[86]

No alternative use campaigns have emerged so far at the array of facilities that design, manufacture, assemble, and test nuclear weapons—a complex that employs over 100,000 people. Only a few studies have been completed on the subject. They highlight the fact that conversion here poses a particularly challenging problem, because many plants are either severely contaminated or too specialized for civilian use. The research and design laboratories may be the easiest to convert. Indeed, during the seventies a relatively small share of their work was devoted to energy research, and they are now again beginning to search for alternatives.[87]

The United States has considerably more experience with adjustment to base closures than it does with production facilities. Within the Department of Defense, an Office of Economic Adjustment (OEA) was created in 1961 for that purpose. But instead of doing comprehensive advance planning to deal with the economic consequences of large-scale disarmament, the OEA has always reacted to closures on a case-by-case basis. In fact, it opposes genuine conversion planning. Rather than weaning communities from dependence on military spending, during the eighties the OEA actually encouraged them to seek Pentagon procurement dollars.[88]

Identifying civilian reuse possibilities for obsolete military bases has once more emerged as a major issue. Current proposals foresee reducing the armed forces by about 250,000 by the end of this decade. An estimated 21,000 base-related jobs will be eliminated as a result of last year's congressional decision to shut down some 86 obsolete military bases by 1995. The Bush administration is now targeting an additional 48 bases, 13 of which are outside the United States, and the list is likely to grow.[89]

Some of the sites slated for closure are a major if not the dominant eco-

nomic factor in their regions. For example, Chanute Air Force Base (AFB) in Illinois accounts for 65 percent of all local economic activity, and Pease AFB in New Hampshire for one-quarter. In California's Alameda County, the U.S. Navy is the second-largest employer. One complicating factor is that of the 86 bases whose closure was announced in 1989, at least 27 are chemically contaminated, and 5 severely so. To deal properly with the accumulated hazardous waste will be a lengthy and costly process; in extreme cases, it may even render civilian reuse impossible.[90]

The Center for Economic Conversion in California's Silicon Valley serves as a national clearinghouse for local conversion initiatives and offers organizing assistance and advice to both local activists and elected officials; it has worked out a model conversion ordinance and maintains a base closure project. In Washington, D.C., the National Commission for Economic Conversion and Disarmament (a private advocacy group with members of Congress, local elected officials, trade union leaders, and economists) was set up in 1988 to urge passage of comprehensive national conversion legislation. It has proposed a "Save America Budget" that would channel $173 billion annually into such areas as public infrastructure, the environment, education, housing, and health care. In May 1990, the Commission held a day of "town meetings" across the country to help articulate local sentiment about the need to cut military spending.[91]

The Jobs With Peace campaign, founded in 1981, has been involved in many local conversion efforts, but it has also approached the issue from a different vantage point. It seeks to organize and give voice to the discontent of people, mostly in inner cities, who fell victim to social program cuts that went hand in hand with the military buildup of the eighties. The campaign's major tool has been local referenda in some 86 cities and towns (a number of which have been won) calling for an assessment of the military's impact on the local economy and for a transfer of funds to housing, health care, education, and other social needs.[92]

The western nation with the second largest share of resources devoted military sector is the United Kingdom. After a major rearmament

program, the U.K. defense industry is going through a contraction "on a scale unknown since the end of the Second World War," according to John Lovering of the University of Bristol. The crisis of military-related employment has rekindled the debate surrounding the Lucas Aerospace campaign waged at a number of production sites from 1975 to 1981. Faced with a wave of layoffs, shop stewards at this major British military contractor formulated a detailed plan involving 150 products, such as medical equipment, alternative energy technologies, and remote control equipment for the handicapped. Although management ultimately rejected the plan and the domestic political climate was hostile to worker participation in decision making, the publicity helped prevent most of the planned layoffs. More important, the Lucas campaign raised awareness and became a tremendous inspiration for many others in Britain and elsewhere.[93] (See Table 4.)

The drawn-out controversy at Lucas Aerospace also stimulated a reassessment within both the union hierarchy and the Labour Party. The Trades Union Congress, the umbrella group for U.K. unions, for example, called for conversion planning as early as 1965 but did little to back up its demand. All the major unions now support conversion, but the Transport and General Workers' Union (the largest single one) has been by far the most active. Its widely quoted *A Better Future for Defence Jobs* proposed local alternative use committees and a national conversion fund. In September 1984, a National Trades Union Defence Conversion Committee was set up to coordinate policy among seven different unions. Meanwhile, conversion committees have also sprung up at the regional level.[94]

The Labour Party's position on conversion has been one of ambivalence. As early as 1977, a study group argued strongly for a reduction of military expenditures and a government-directed conversion program. Although the party was then in power, however, it took no action. After the Conservative Party won in 1979 and the cold war re-emerged, Labour belatedly incorporated many approaches arising out of the Lucas discussion in its policy program. In a 1986 report, the party promised if elected to create a three-tiered conversion structure involving plant-based alternative use committees, regional conversion councils, and a National Agency for Industrial Conversion and Recovery

Table 4: Recent Conversion Initiatives and Studies, United Kingdom

Location, Year Started	Events and Reports
Alternative Employment Study Group, Dumbarton, Strathclyde, Scotland, 1984	Formed by trade union and peace groups. Report on impact of Faslane and Colport nuclear submarine bases on local economy. Terminated in 1988 due to lack of adequate funding.
Vickers Shipyard, Barrow Alternative Employment Committee (BAEC), 1984	1987 report "Oceans of Work" assesses alternatives to Trident submarine production in marine technology and renewable energy. Vickers employs more than one-third of Britain's shipbuilding labor force. Virtually all work is defense-related. Declining employment despite continued profitability. Barrow City Council now involved in diversification efforts.
Greater London Conversion Council (GLCC), 1985	GLCC created by metropolitan government (GLC). Series of reports on impact of defense spending on local economy; electronics and aerospace sector studies. Financial support for alternative use campaign at North London Royal Ordnance Factory. GLC abolished by Thatcher in 1986; GLCC ceased to operate in March 1988 for lack of funds.
Joint Action Committee (JAC), Royal Naval Stores Depot, Llangenerch, South Wales, 1986	"Alterplan 87" launched as alternative to loss of hundreds of jobs. Feasibility study conducted. Conversion to network of small business proposed, with some success. Strong union support. Ministry of Defence fairly sympathetic toward JAC's efforts.
Coventry Alternative Employment Research, 1988	Study "Tanks and Turbines" on military industry employment in Coventry completed. Study of alternatives under way.
Trade Union Research Unit, Scotland, 1988	Report "Enquiry into Defence Employment in Scotland."
British Aerospace (BAe), Bristol, 1989	Biggest single complex in W. European aerospace industry, accounting for almost 30 percent of local manufacturing employment. 1,000 jobs threatened. Workers generated over 100 alternative product ideas. City Council commissioned a study of alternatives and set up a Local Defence Industry Forum. Management, hostile toward the initiative, is trying to proceed with announced job cutbacks.
BAe, Warton, Lancashire, Northwest, 1989	Shop stewards proposed study of alternatives to Tornado warplane. Coordination with Tornado workers in other countries.

Worldwatch Institute, based on various sources.

within the Department of Trade and Industry. This remains the most detailed policy statement adopted to date by a major British party.[95]

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A 1989 Labour Party policy review for the nineties, by contrast, had comparatively little to say about conversion. Prompted by the surprising turn of events in Eastern Europe, yet another statement was issued in May 1990. The Labour leadership has long vowed to lower spending on nuclear arms and to beef up conventional forces instead. This stance looks not only more and more outdated, it also implies that conversion under a Labour government would be a rather limited undertaking.[96]

While conversion has languished on the national level in the United Kingdom, an informal institutional structure for a conversion network has emerged. In 1985, an Arms Conversion Group was established at the School of Peace Studies at Bradford University as a forum for various local campaigns. And a number of small, independent agencies—including the Centre for Alternative Industrial and Technological Systems set up in 1978 at the Polytechnic of North London and the Network of Product Development Agencies in Sheffield—offer practical assistance to local campaigns. The Unit for Development of Alternative Products at Coventry Polytechnic helps the local unemployed to start companies making socially useful products.[97]

Grassroots conversion campaigns have found a niche of support among local governments. British municipalities are struggling to formulate local strategies for economic development to cope with the devastating effects of Prime Minister Thatcher's economic policies. Their growing involvement in conversion and diversification efforts is being coordinated by the Centre for Product Development Services in Sheffield. They hope to provide an "early-warning" service monitoring potential future layoffs, help improve the quality of conversion campaigns, and lobby for nationwide diversification policies.[98]

Local city councils provide a much needed institutional backup for conversion initiatives. Yet their financial and legal powers were severely circumscribed by the Thatcher government during the second half of the eighties. The Greater London Council, a key supporter of conversion campaigns, was abolished along with other metropolitan govern-

"In the United Kingdom, an informal institutional structure for a conversion network has emerged."

ments in 1986. Given the weakness of local authorities and unions, it is unlikely that a meaningful conversion policy can be shaped without either a change of heart or a change of government in Downing Street.

In some respects, the West German situation is comparable to that in the United Kingdom: the ruling Christian Democrats disavow the need for any active government role in advancing conversion, and the Social Democrats (SPD), while in opposition, have discovered the virtues of such a policy. In its most recent statement, the SPD pledges to implement conversion once elected to national office. A working group established by the party's parliamentary group is to recommend by mid-1990 how to deal with the economic effects of a post–cold war security policy. The Green Party, meanwhile, is strongly in favor of conversion, but in keeping with its proclivity toward decentralization it has primarily supported local and regional efforts.[99]

As in the United Kingdom, worker-initiated campaigns have played an important role in the West German conversion discussion. From the outset, environmental considerations have been of paramount importance in their efforts. There are now about 20 such alternative use committees, mostly in the northern part of the country. (See Table 5.) This should come as no surprise, because that region is heavily dependent on the military sector and even its civilian industries are mired in crisis, whereas southern Germany has benefited from the growth of high-tech industries. In Kiel, one in every five industrial workers is employed in military industry; in Hamburg, one out of four shipyard workers and one-tenth of those in the electronics industry fall in this category; in Bremen, one-quarter of the workers in the electronics industry produce armaments.[100]

Few alternative use committees are found in the southern part of the country, but the efforts of one group at the Bavarian facilities of Messerschmidt-Bölkow-Blohm (MBB) in Augsburg have been fairly successful. The group was a catalyst in bringing about a unique partnership between MBB and the city government of Augsburg: in 1988, "Project PUR" (Program for Environmental Improvement and Resource [illegible]vation) was initiated to explore how MBB's knowledge can be [illegible] to environmental problems rather than deadly weaponry. The

Table 5: Selected Alternative Product Working Groups, West Germany

Initiative, Location, Year Started	Activities, Events, and Studies
Blohm & Voss Shipyard, Hamburg, November 1980	60 percent of production military-related. Alternative product proposals: water and waste treatment, desalinization, biogas, wind power for energy generation and shipping, and energy-saving technologies. The working group's activities put pressure on the company to engage in diversification measures that were relatively successful.
Krupp MaK, Kiel, January 1981	Leopard II tank assembly declining. Alternative product proposals: innovative rail systems, co-generation, wind power. Cooperation with railway workers union to support alternative transportation systems. Barry Commoner provided advice on alternative energy options. Management mostly uncooperative, but pursued some ideas originally proposed by the working group, including a wind energy plant on the North Sea island of Helgoland.
MBB (Aerospace), Bremen, March 1982	Job losses since early eighties; more layoffs expected with termination of Tornado warplane project. Some 62 alternative product ideas, including solar collectors, biogas, wind energy, energy storage and transport systems, and high-tech zeppelins (for surveillance of North Sea environment). Management fairly responsive, showed interest in pursuing wind energy market. Close coordination with working group at MBB plant in Augsburg.
MBB, Augsburg, November 1982	Working group was formed to think about alternative products in place of Tornado warplanes. Alternative product areas: water treatment, desalinization, recycling, low-noise engines, air quality measuring systems, wind power. Negotiations with management to form joint alternative use committee failed, but working group was catalyst in bringing about PUR Project in 1988.
Lloyd Shipyards, Bremerhaven, 1984	Military share of production: 10 percent. Alternative product proposals focus on waste management and recycling.
HDW Shipyards, Kiel, 1985	Approximately half of turnover military-related. Alternative use ideas: maritime oil retrieval system, recycling technologies, hydrogen fuel.

Source: Worldwatch Institute, based on various sources.

"The emphasis in West Germany has suddenly shifted from employment in arms production to that on military bases."

project initially focuses on boosting energy efficiency and reducing water pollution by Augsburg's textile industry; at a later stage, it will explore technologies for an environmentally more benign urban transportation system. An explicit goal is to combine environmental improvements with secure employment. Although this endeavor is a small one, it could nevertheless be emulated elsewhere.[101]

In many other cases, however, corporate executives have not been cooperative. Management opposition to alternative product campaigns at Krupp MaK in Kiel led some workers to look beyond the factory gates for support. In August 1986, they launched the Förderverein Neue Produktion (FNP, the Association for the Advancement of New Production) to generate concrete proposals for alternatives that meet three criteria: minimal use of energy and materials, environmentally benign use and disposal of products, and improvement of working conditions. To date, FNP's work has focused on innovative rail systems and wind energy for ships. It identifies companies interested in putting these ideas to practical use, and seeks to mobilize government support in creating markets for these products. The group received financial support from the Kiel city government and may obtain additional funds from the state government of Schleswig-Holstein.[102]

The metal workers' union (IG Metall)—for a long time the only West German union active in conversion matters—formed a working group on Defense Technology and Employment as early as 1977 to advance proposals for alternative production. The IG Metall has facilitated the coordination of various plant-based conversion initiatives and helped integrate them into the union organization. Its Innovation and Technology Advisory Bureau in Hamburg (created in 1979) and the Cooperation Bureau in Bremen (since 1982) have lent important practical support to workers' alternative use committees.[103]

Prompted by a growing realization that troop deployments in Europe will be cut sharply, the emphasis in West Germany has suddenly shifted from employment in arms prod[illegible]on to that on military bases. As research by Christian Wellm[illegible] of the Peace Research Institute [illegible]t shows, arms production directly employs about 190,000 peo[illegible] percent of military-related jobs, whereas jobs with the armed

forces are numerically far more important. (See Table 6.) The government announced in late 1989 it was planning to reduce the size of the *Bundeswehr* from 495,000 to 400,000 soldiers by the mid-nineties; the opposition Social Democrats have demanded an army of just 250,000 or perhaps even 100,000.[104]

West Germany is in a peculiar situation because a sizable portion—roughly one-quarter—of its military-related employment is sustained by large contingents of NATO troops stationed there. Goods and services purchased by some 400,000 troops and an equal number of their dependents yields some 20 billion deutsche marks ($12 billion) annually. Any withdrawal of these foreign troops would clearly exact an economic price and thus diminish the domestic peace dividend in the short term. Since the purchases are paid for by the respective governments, West Germany would have to mobilize extra funds to compensate for the demand of any departing foreign troops. For 40 years, the cold war rendered discussion of these issues academic. But they will soon become real-life problems: some 55,000 U.S. troops are likely to be pulled out, Belgium and the Netherlands have announced they will withdraw some or perhaps all of their troops, France may remove a third of its contingent, and the strength of the British Army on the Rhine may be similarly reduced.[105]

As disarmament has come closer to the realm of the possible, conversion-related activities have begun to focus more on specific local and regional implications. The prospect of troop withdrawals and military spending cuts has generated considerable anxiety—and a rash of activities—among local and state elected officials, opposition politicians, and grassroots groups in the areas most dependent on the military and thus most vulnerable to these developments.

The government of Rheinland-Pfalz, where 9 percent of employment is military-related, is preparing a report on the economic consequences of withdrawing U.S. troops and proposes a federally assisted infrastructure program to offset the impact of a shrinking military economy. The government of Schleswig-Holstein has commissioned a study on the future of a naval base in Flensburg, and is considering extending financial support for a peace and conversion research institute being estab-

Table 6: Military-Related Employment in West Germany, 1970 and 1984[1]

Employment	1970 (thousand)	1984 (thousand)	1984 (percent)
Arms production for German armed forces (*Bundeswehr*)	169	154	12
Arms production for export	20	37	3
Production of goods and services delivered to *Bundeswehr*	122	102	8
Production of goods and services delivered to NATO troops in West Germany	149	190	15
West German *Bundeswehr* troops	450	481	37
Civilian *Bundeswehr* employees	173	182	14
Civilians employed by NATO troops[2]	137	117	9
Other[3]	9	42	3
Total	1,229	1,305	100[4]
Employment financed by West Germany	935	972	74
Employment financed by other countries	294	333	26

[1]Sufficient data are not available for more recent years than 1984.
[2]Some 11,000 civilians employed by NATO troops in West Berlin are paid by the West German government.
[3]Civil defense and conscientious objectors.
[4]Does not add up to 100 due to rounding.

Source: Adapted from Christian Wellmann, *Abrüstung und Beschäftigung - ein Zielkonflikt?* (Frankfurt and New York: Campus Verlag, 1989), various tables.

lished at the University of Kiel. In Bremen, a Foundation for Arms Conversion and Peace Research was founded in 1989 with the blessing of the local government.[106]

ersion legislation has been introduced in the *Landtag* (state parlia-

ment) of Bavaria by the Green Party. In Munich, Bavaria's capital and probably the leading arms production center in West Germany, Social Democratic members of the city council, the Greens, and the grassroots Working Committee for Arms Conversion asked the city government to study the area's military economy and its potential for conversion into environmental protection; a "conversion council" was also called for. In neighboring Baden-Württemberg, the second most important arms-producing region, the opposition Social Democrats have asked the state government to formulate a conversion policy; they prepared a study of the military economy and proposed a catalog of specific measures to facilitate a changeover to civilian uses.[107]

More than in any other European nation, the future of disarmament and conversion in West Germany depends on the shape of a post–cold war European security order—in particular, the conditions for German unification, whether there will be any special ceilings on German armed forces and military production, and whether the country will belong to any military alliance or be neutral. Due to its economic might and central location, a unified Germany will be the anchor of a new Europe. It could be either a center of stability or a cause of renewed concern among its neighbors. The willingness of other countries, including the Soviet Union and the United States, to consider far-reaching disarmament measures hinges on German actions.

In Italy, conversion has recently become a topic of intense interest. Italian political parties had long rejected the conversion idea, and defense policy was virtually a taboo subject. But the tide suddenly turned in the late eighties: even though the country's military industry is only about half the size of its British, French, and West German counterparts, it has become the object of close scrutiny. The new East-West détente has been an obvious factor, magnified by plummeting arms exports and growing pressure from the peace movement and trade unions.[108]

A variety of conversion bills are now being discussed in the parliament. The Minister of State Industry set up a commission in spring 1989 to study the conversion of the half of the military industry that is state-owned. The group lacks a clear mandate, however, and has to date not

"The future of disarmament and conversion in West Germany depends on the conditions for German unification."

been very active. There are some encouraging signs on the regional level. The government of Liguria, the most military-dependent region, has commissioned a study on the prospects for conversion. Tuscany authorities have published monographs concerning the situation in individual military industries and granted money to private groups for further research. And the Lombardy government has expressed an interest in financing a study on conversion and civilian alternatives in the heavily military-reliant Brescia region.[109]

The involvement of the Italian labor movement in the conversion issue has echoed its rather turbulent internal politics. Since the early fifties, unions in Italy have been divided into three competing organizations. The creation of a single metalworkers union in the late seventies coincided with a flourishing of interest in conversion, in part stimulated by the Lucas experience. A renewed split in the early eighties preoccupied unionists' energies, and conversion disappeared from the agenda until the late eighties, when the three rival metalworkers unions issued a joint statement reaffirming their support for conversion.[110]

The most unique feature of the Italian unions' activities is their demand that a clause committing management to increase the share of civilian production be made part of collective bargaining agreements. In 1988 and 1989, such contracts were signed at two major military firms, Aermacchi (an aircraft producer) and Galileo (an optics firm).[111]

Over the past few years, a network of "military industry observatories" has emerged. Affiliated with trade unions, the peace movement, and universities, its aim is to document the regional and local significance of the military industry and to examine the prospects for conversion. The observatories have adopted a common methodology, coordinate activities, publish a joint newsletter, and plan a series of inter-regional conversion seminars. Currently groups exist in and around Milan, Genoa, Florence, Bologna, and Rome. Efforts are being made to expand this network to Naples, Turin, and Venice.[112]

Archivio Disarmo in Rome, for example, launched a study in 1987 of five militar[illegible] enterprises in the electronics and mechanics sectors to help make a case for the adoption of a local industrial conversion plan. In

consultation with shop stewards, the Archivio identified some 40 alternative products that could be produced with existing technologies, with an emphasis on preventive medicine and the environment. In Florence, the Tuscany Economic and Social Research Institute is building up a regional data base and is preparing a diversification study for a small aviation electronics company. The Forum for Problems of Peace and War, with financial support from the regional government, has conducted a census of military production in Tuscany and will prepare a series of conversion case studies. The Union of Scientists for Disarmament, also in Florence, has prepared a study of civilian applications of infrared cameras manufactured by the Galileo company.[113]

Conversion-related activities are thus flourishing in Italy where there was virtually no interest only a few years ago. The idea of conversion is becoming more accepted, though as in other western countries this should not veil the still considerable resistance among military industry management and the armed forces.

Among western governments, Sweden's has been the most sympathetic to conversion. It is the only nation that responded constructively to a 1982 U.N. General Assembly suggestion that member states do a detailed study of their military industries. The result was the 1984 landmark report *In Pursuit of Disarmament*. Also known as the Thorsson report (Under-Secretary of State Inga Thorsson chaired the group that prepared the study), it found conditions quite favorable to conversion: few Swedish firms and communities depend heavily on military spending, and cutting military expenditures in half would affect less than 1 percent of the Swedish labor force. The Thorsson report called for a Council for Disarmament and Conversion and a national conversion fund to be financed by a 5-percent levy on arms export sales. It further envisioned conversion funds at each defense facility, paid for by setting aside 1 percent of the value of domestic military contracts; to become eligible for such funds, contractors would have to match them with their own capital. A follow-up report, with some modifications to the original suggestions, was published in spring 1988.[114]

Yet despite continued interest within the Foreign Ministry, among some military firms, and within the trade union movement, the government

"Conversion-related activities are flourishing in Italy where there was virtually no interest only a few years ago."

eschews an active conversion policy. Part of the reason is that contractors do not want to take the plunge without government subsidies, something not included in the Thorsson plan. Furthermore, as a nonaligned country perched between two historically hostile military blocks, Sweden has always felt it needed to maintain a strong, independent defense industry. While the fading of the cold war allows for some modification, policymakers are still hesitant to change course. A new defense posture is to be drawn up in 1991.[115]

In the meantime, the case for alternative use planning remains compelling. The Stockholm business magazine *Veckans Affärer* reports that Swedish arms manufacturers are struggling with plunging sales; over the next five years, some 4,000–5,000 jobs could be lost. Bofors, the largest company, has cut its work force by one-third. Indeed, the prospects of lower defense budgets and a gradually shrinking military force ensure that conversion will increase in political importance.[116]

The labor movement in virtually all western countries today embraces conversion, but unions' ability to push for its implementation varies considerably. Those in West Germany are among the strongest and most unified. That country's "co-determination" laws, while stopping far short of the equal decision-making powers that their name suggests, give worker representatives greater opportunities to influence corporate affairs. British unions, by contrast, have not only been battered by a hostile Thatcher government, but their fragmented organizational structure has been an additional impediment. Unlike in other countries, where a single union organizes all blue-collar workers in a factory, British workers are represented along vocational lines by different unions. One important achievement of the Lucas Aerospace campaign was to overcome these divisions through formation of a national "combine committee." Organized labor in the United States is weak because only about 20 percent of the work force is unionized. Thus U.S. unions have been less of a driving force in the conversion discussion than their counterparts across the Atlantic.

On the other side of the equation, the attitude of military contractors is obviously of great importance. With fewer defense dollars to go around, the industry has caught the merger fever. The survivors will

account for a greater share of the military pie and thus have considerable leverage over the course of any adjustment policy. In West Germany, the automobile manufacturer Daimler-Benz has emerged as the dominant military contractor: its subsidiary Deutsche Aerospace now accounts for about one-third of the country's total armaments output and is participating in 70 percent of all arms development projects. The company intends to cut its military dependence, currently over 40 percent, in half—but only over 10–15 years. Of the two dominant companies in the United Kingdom, British Aerospace is attempting to diversify but General Electric actually continues to strengthen its military business. In the United States, although most firms remain opposed to conversion planning, Bath Iron Works in Maine encourages its employees to think about alternative use possiblities.[117]

Among western countries, the task of dealing with the economic effects of disarmament appears easiest for countries like the Netherlands, Sweden, Belgium, and Austria, because their military sectors are quite small relative to the overall national economy. Adjusting the armaments industry in larger countries should be easier for West Germany and Italy than for the United States or the United Kingdom. The former two devote a considerably smaller share of financial and scientific resources to defense, and their military industries tend to be less specialized and thus more integrated into the overall economy. Arms sales are less significant for many German military contractors than they are for similar firms in other countries.[118]

An Alternative Agenda

Local conversion campaigns help raise awareness of the adverse impact of military spending, and they are vital to the process of gathering support for a national conversion policy. But local or regional authorities often do not have the means or the political power to guarantee the implementation of alternative use proposals. Ultimately, the success of grassroots initiatives depends on the passage of comprehensive national legislation that provides a mandatory framework for the transfer of resources from military to civilian applications.

"Ultimately, the success of grassroots initiatives depends on the passage of comprehensive national legislation."

Currently, no such legislation is in force anywhere in the world. In China, conversion has been carried out by administrative decree rather than by public deliberation and legally codified measures. Legislative proposals have been made in a number of countries, however. In the Netherlands, the government coalition parties twice voted down parliamentary proposals in the mid-eighties to create a National Conversion Commission. In Italy, a bill to give Parliament greater control over arms exports contains some relevant provisions; pressure for more straightforward conversion legislation is mounting, as four bills have been introduced by opposition parties in 1988 and 1989. The Soviet parliament is currently considering a draft conversion bill.[119]

In the United States, a total of five bills—four in the House and one in the Senate—have been introduced. The most comprehensive of these, the Defense Economic Adjustment Act (H.R. 101) introduced by Representative Ted Weiss of New York, incorporates the features crucial to the success of a conversion strategy. First offered in 1977, the Weiss bill is essentially a refined version of the National Economic Conversion Act introduced in 1963 by Senator George McGovern. Because of its complexity, the Weiss bill needs to be approved by a variety of congressional committees before the full House of Representatives could vote on it. But as it has become clearer that the military expansion of the eighties has come to an end, the legislation has attracted growing support. Sixty-eight members of the House are co-sponsoring the bill; it may be brought to a floor vote in the context of this year's defense appropriations bill.[120]

The Weiss bill has become something of a model for conversion proponents everywhere. It calls for a Defense Economic Adjustment Council charged, among other things, with preparing general guidelines for conversion and disseminating conversion-related information. The bill also requires every military base, laboratory, and production facility with more than 100 employees to establish an Alternative Use Committee as a prerequisite for future eligibility for military contracts. Management and labor would be evenly represented, and nonvoting representatives of the local community would be included. The committees would develop and review every two years a conversion blueprint. The Weiss bill facilitates conversion planning by requiring

the Secretary of Defense to provide one year's advance notice of any changes in procurement contracts that will lead to layoffs.[121]

To smooth adjustment, occupational retraining of military industry employees would be required. Workers displaced as a result of defense cutbacks would be eligible for temporary income maintenance and relocation allowances. A national employment network would be created to help them find new jobs. The legislation also specifies that communities "substantially or seriously affected" by reduced defense spending "shall be eligible for Federal assistance for planning for economic adjustment to avoid substantial dislocations." An economic adjustment fund would be created to finance these programs, funded by 10 percent of any projected savings in military spending.[122]

Although establishing a legal framework is essential, it is social and economic policies that will inject life into any conversion undertaking. A well thought out, imaginative conversion process must encompass new approaches to macro-economic, employment, technology, infrastructure, and environment policies—particularly if it is to be geared toward socially useful and environmentally sound production and consumption. Unfortunately, under the laissez-faire approach that dominated macroeconomic policy in many western countries during the eighties, conversion is unlikely to take such a direction. Instead, many mainstream economists prefer to use military savings to reduce taxes or close budget deficits. But conversion cannot succeed if there is no compensation for the military's diminished demand for goods and services.

A more activist governmental role is crucial, but it is also obvious that too centralized an approach is inappropriate, because of the inherent dangers of bureaucratization and inflexibility. If the eighties have taught the world any lesson, it is that neither completely unfettered private enterprise nor rigid central planning are likely to provide useful answers to the challenges ahead. This prompts a question about the proper role of public policy: To what degree should government "interfere" in the market to bring about the rather fundamental redirection of priorities needed?

The answer, of course, varies from country to country. It depends on the

"Neither completely unfettered private enterprise nor rigid central planning are likely to provide useful answers to the challenges ahead."

"political culture," in particular the acceptance of and previous experience with public policy. In general terms, the most effective approach might be to create the overall framework and provide the incentives for the production of socially useful products for which there is an obvious need but little or no effective market demand. The centerpiece of such a policy would be an alternative research and capital investment agenda to create initial market demand. The program might include measures to support the development of nonpolluting, appropriate-scale production technologies, enhance renewable sources of energy, boost energy efficiency and reforestation, strengthen public transportation, provide affordable housing and preventive health care, and improve educational services. In the United States, the Weiss bill addresses this need.[123]

Beyond the overall framework provided by public policy, it is probably best to leave the actual implementation to local and regional groups and authorities. A decentralized effort tends to be much more sensitive to individual communities' strengths and weaknesses. Enormous regional and local imbalances are created or exacerbated by military spending priorities—between those regions receiving a major share of military contracts and those less dependent on the military sector; between those favored and those disadvantaged by military priorities.

The geography of the military economy has taken vastly different forms in different countries. In the United States, particularly in California, the areas sustained by arms spending can be easily found on a map: skirting much of the traditional industrial heartland and its troubled inner cities, military industry employees have settled in distinct, relatively homogeneous suburban communities, in what might be described as the military equivalent of apartheid. In Britain, on the other hand, as elsewhere in Europe, there has been no such pronouncedly separate spatial development. The winners and losers of large-scale military spending "are more likely to pass each other in the shopping centers of their towns," as John Lovering of the University of Bristol put it. Military programs there have created "islands of prosperity" amid a sea of urban decay and decline.[124]

To be effective, a conversion policy needs to be tailored to the specific needs of individual regions and to invest local and regional govern-

ments with sufficient authority and economic wherewithal in the entire endeavor. This implies a reversal of current trends. In short, conversion policy cuts right to the heart of governance structures.

Emphasizing the peculiarity of local conditions does not mean that international coordination has no role. Arms production is becoming more internationalized, and the deployment of troops abroad injects a significant international dimension as well. The Commission of the European Community has excluded the military industry from its preparations to create a unified market by 1992. Because the Community has increasing sway over such matters as member states' subsidies to industry, however, its decisions will have at least an indirect impact on the prospects for conversion. The West German Greens and other observers have demanded a more straightforward policy. They propose involving the democratically elected European Parliament rather than the Commission, and creating a Europe-wide conversion fund.[125]

Conversion can be seen as a confidence-building measure: it underscores a country's intention to disarm. The United Nations or perhaps another international organization could play a role in developing international standards to verify the sincerity of individual nations' conversion measures. In his December 1988 address to the U.N. General Assembly, Soviet President Gorbachev proposed that "all states, in the first place major military powers, should submit to the United Nations their national conversion plans." The United Nations could establish a kind of global clearinghouse where each nation's concrete experiences with alternative use projects could be shared with others. The organization has been involved in related questions for a long time. It has provided a forum for discussing the relationship between disarmament and development, and the International Labour Office in Geneva maintains a Disarmament and Employment Program that since 1984 has commissioned a series of research reports.[126]

A few efforts are being made on the company level, too, to cooperate across borders. Part of the Soviet conversion experiment is an effort to open up export markets for conversion products. At an international exhibit in April 1990 in Munich, for example, the Soviet Union present-

ed some 1,200 goods manufactured by 300 former military enterprises. To promote the idea of international conversion ventures, Archivio Disarmo in Rome is working to put companies in West Germany, Hungary, and the Soviet Union in touch with Italian military contractors.[27]

On the grassroots level, meanwhile, contacts among activists are growing rapidly. A series of conferences have been held in recent years in Hamburg, Boston, Eastbourne (UK), Stockholm, Rome, and Brescia (Italy) to bring together conversion advocates—unionists and academics—from different countries. At Sweden's Uppsala University, a Military Adjustment Global Information Center (MAGIC) has been set up to collect information on conversion studies and other activities and to help establish an international conversion network.

The lack of an active government conversion program in the West would seem to indicate that it will be a struggle to translate this concept into reality. At the moment, the prospects for such a policy appear brighter in Europe than in the United States. Nations there have a stronger tradition of public intervention in economic policy, and the labor movement is more influential. Weaving together the strands of a conversion coalition remains essential to claim the peace dividend. A realignment in the political geography—as appears in the making in Western Europe, where Green movements have been on the rise—provides some hope that an ecologically inspired alternative use strategy will get a more serious hearing.

The gathering pressure for disarmament suggests strongly that conversion will be a topic of growing importance during the nineties. As the debate about the essence of security is broadened to embrace economic vitality, social justice, and ecological stability, there is a growing desire to redirect resources to these areas of neglect. The challenge is to channel this desire into concrete action.

Notes

1. Michael Renner, *National Security: The Economic and Environmental Dimensions*, Worldwatch Paper No. 89 (Washington, D.C.: Worldwatch Institute, May 1989).

2. For a comprehensive list of current domestic and international armed conflicts, see Peter Wallensteen, ed., "States in Armed Conflict 1988," Department of Peace and Conflict Research, Report No. 30, Uppsala University, Sweden, July 1989.

3. Officially, START cuts strategic nuclear weapons by 50 percent, but since START "counting rules" disregard certain weapons categories, actual reductions may come to no more than about 30–35 percent; Robert S. Norris et al., "START and Strategic Modernization," *Nuclear Weapons Databook Working Papers 87–2* (Washington, D.C.: Natural Resources Defense Council, 1987). One observer estimates that reductions will only reach 10 percent; Bill Robinson, "Big Promises, Small Cuts," *Ploughshares Monitor*, March 1990. For latest developments in chemical weapons diplomacy, see Michael R. Gordon, "In a Switch, Bush Offers to Stop Producing Chemical Weapons," *New York Times*, May 9, 1990.

4. U.S. Arms Control and Disarmament Agency (ACDA), *World Military Expenditures and Arms Transfers 1988* (Washington, D.C.: U.S. Government Printing Office 1989); Michael Brzoska and Thomas Ohlson, eds., *Arms Production in the Third World* (London: Taylor & Francis, 1986).

5. For a definition of new threats, see The Commission on Integrated Long-Term Strategy, *Discriminate Deterrence* (Washington, D.C.: U.S. Government Printing Office, January 1988). For official view that military-industrial capacity needs to be maintained in case cold war hostilities re-emerge, see U.S. Defense Science Board, *The Defense Industrial and Technological Base*, Final Report to the Office of the Under-Secretary of Defense for Acquisition (Washington, D.C.: U.S. Government Printing Office, October 1988); Center for Strategic and International Studies, *Deterrence in Decay: The Future of the U.S. Defense Industrial Base* (Washington, D.C.: 1989). For view of military contractors, see Richard L. Berke, "Lobbying Steps Up on Military Buying as Budget Shrinks," *New York Times*, April 9, 1990.

...n Anthony et al., "Arms Production," in Stockholm International Peace

Research Institute, *SIPRI Yearbook 1990: World Armaments and Disarmament* (New York: Oxford University Press, 1990).

7. Lloyd J. Dumas, "Economic Conversion: The Critical Link," in Lloyd J. Dumas and Marek Thee, eds., *Making Peace Possible: The Promise of Economic Conversion* (Oxford: Pergamon Press, 1989).

8. Lloyd J. Dumas and Suzanne Gordon, "Economic Conversion: An Exchange," *Bulletin of the Atomic Scientists*, June/July 1986.

9. For corporate diversification attempts, see Jonathan Feldman et al., "Criteria for Economic Conversion Legislation," Briefing Paper No. 4, National Commission for Economic Conversion and Disarmament, Washington, D.C., December 1988, and Mark Paquette, "What's Happening to the Defense Industry?" *The Minnesota Peace Economy News*, Winter 1990.

10. Greg Bischak, Report on "International Roundtable Meeting: Survival of Civilization, Disarmament for Development, Conversion," sponsored by the All-Union Central Council of Trade Unions, Moscow, November 2–3, 1989, mimeographed.

11. Feldman et al., "Criteria for Economic Conversion Legislation."

12. Ibid.

13. Seymour Melman, *The Permanent War Economy* (New York: Simon and Schuster, 1974, revised edition 1985).

14. Boeing-Vertol from Seymour Melman, *Profits Without Production* (New York: Alfred A. Knopf, 1983); Rohr Corporation from Melman, *The Permanent War Economy*; Rockwell and Grumman from Richard W. Stevenson, "Hard Choices for Arms Makers," *New York Times*, November 29, 1989, and from Leslie Wayne, "Arms Makers Gird for Peace," *New York Times*, December 17, 1989.

15. Eric Weiner, "U.S.-Soviet Makers Plan Supersonic Business Jet," *New York Times*, November 28, 1989.

16. Paul Quigley, "The Opportunity of Disarmament: Investigating

Alternatives for Military-Supported Employment in Coventry," paper presented at conversion conference "Riconvertire per un Altro Sviluppo," Rome, November 3–5, 1988.

17. Global estimates from Renner, *National Security: The Economic and Environmental Dimensions.*

18. Distribution of military spending by state calculated from "The Cost of Peace: Where the Money Goes," *USA Today*, December 6, 1989; metropolitan areas from "The Peace Economy," *Business Week*, December 11, 1989. Share of states' total output going to the military sector from L. Douglas Lee, Chief Economist, Washington Analysis Corporation, testimony presented at Hearings of the Joint Economic Committee of the U.S. Congress, "Economic Adjustments After the Cold War," December 12, 1989.

19. Secretary of State for Defence, *Statement on the Defence Estimates, Vol. 2, 1990* (London: Her Majesty's Stationery Office, 1990), Table 6.9; Sergio A. Rossi, "Italy," in Nicole Ball and Milton Leitenberg, eds., *The Structure of the Defence Industry. An International Survey* (London and Canberra: Croom Helm, 1983); France from International Labor Office, "The Conversion of Manpower Employed in the Armaments Industry and Related Activities," Disarmament and Employment Program, Working Paper No. 6, Geneva, 1987; Bernard Adam, "L'Industrie d'Armement en Belgique: Difficultés, Crise et Tentatives de Diversification," Disarmament and Employment Program, Working Paper No. 13, International Labour Office, Geneva, 1989; Klaus R. Kunzmann, "Military Production and Regional Development in the Federal Republic of Germany," in Michael J. Breheny, ed., *Defence Expenditure and Regional Development* (London and New York: Mansell Publishing Ltd., 1988); Klaus Schomacker et al., *Alternative Produktion Statt Rüstung* (Köln: Bund Verlag, 1987).

20. Julian Cooper, "The Soviet Defence Industry and Conversion: The Regional Dimension," Disarmament and Employment Program, Working Paper No. 10, International Labour Office, Geneva, 1988.

21. Verification of the 1987 INF treaty is expected to cost the United States some $200 million per year. Checking compliance with an impending conventional arms treaty in Europe has been estimated at an initial $570 million for NATO, followed by annual outlays of nearly $200 million. Costs for the Soviet Union

are unknown. See "The Peace Non-Dividend," *The Economist*, November 4, 1989. It may take as many as 350 hours of labor to destroy a single tank. A U.S. bomber costs an estimated $7.3 million per year to maintain and operate, but $14,500 to destroy. A chemical weapons treaty may not yield any savings because the destruction of chemical arms costs more than their production. Klaus Engelhardt and Emil Rechtziegler, "Rüstungskonversion-Neue Dimension und Herausforderung," *IPW Berichte*, 3/1990.

22. Because a START accord will not prescribe how to meet the numerical weapons limits it codifies, additional options are possible within that range; Stephen Alexis Cain, *The START Agreement: Strategic Options and Budgetary Savings* (Washington, D.C.: Center on Budget and Policy Priorities, 1988). Initial savings would be small but rise substantially over the years. For example, halting the B-2 Stealth bomber, rail-mobile MX missile, and Midgetman ICBM projects would save less than $2 billion in fiscal year 1991, but more than $30 billion by fiscal year 1995; Susan F. Rasky, "Democrats Shift on Military Cutbacks," *New York Times*, March 15, 1990. Potential Soviet savings from Barry Blechman with Ethan Gutmann, "A $100 Billion Understanding," *SAIS Review* (School for Advanced International Studies, Johns Hopkins University), Summer-Fall 1989.

23. Current proposals concerning superpower troop limits in Europe from Michael R. Gordon, "Troop Proposal an Effort to Catch Up With Changes in Europe," *New York Times*, February 1, 1990. If U.S. troop withdrawals were doubled, to 155,000, savings might reach $48.1 billion by 1995. U.S. conventional savings from Rasky, "Democrats Shift on Military Cutbacks," and from Robert Pear, "Economic Effect of Cutting Troops in Europe Assessed," *New York Times*, February 2, 1990. Potential Soviet conventional force savings from Blechman with Gutmann, "A $100 Billion Understanding."

24. Melman, *The Permanent War Economy*; Pentagon studies from "No Business Like War Business," *The Defense Monitor*, Vol. 16, No. 3, 1987; Census Bureau data from Inga Thoreson, "Disarmament and Development: An Idea Whose Time Should Have Come," *IDS Bulletin* (Institute of Development Studies, University of Sussex), October 1985.

25. Dumas and Gordon, "Economic Conversion: An Exchange", Jonathan Feldman, "An Introduction to Economic Conversion," Briefing Paper No. 1,

National Commission for Economic Conversion and Disarmament, Washington, D.C., May 1988.

26. Adam Kowalski, "Swords Into Chocolate Truffles," *New Scientist*, November 11, 1989; Alexandri Remisov, "Disarmament Treaties and Conversion of Military Production in USSR," *IDOC Internazionale* (International Documentation and Communication Center, Rome), September/October 1988; Alexei I. Izyumov, "The Demilitarization of the Soviet Economy," *Telos*, Summer 1989; Alexei Izyumov, "The Other Side of Disarmament," *International Affairs*, No. 5, 1988; Philip Hanson, "Economic Reform and the Defense Sector," *Report on the USSR*, April 28, 1989.

27. Feldman et al., "Criteria for Economic Conversion Legislation"; Dumas and Gordon, "Economic Conversion: An Exchange"; for a recent example of pork barrel politics involving military bases, see Dan Morgan, "As Base-Closings Loom, Hill Looks Askance at Military Construction," *Washington Post*, February 15, 1990.

28. For a more detailed discussion of lost economic opportunities, see Melman, *The Permanent War Economy*; Michael Dee Oden, *A Military Dollar Really Is Different: The Economic Impacts of Military Spending Reconsidered* (Lansing, Mich.: Employment Research Associates, 1983); net Pentagon tax from Employment Research Associates, *Bankrupting America* (Lansing, Mich.: 1989).

29. U.S. arms production employment, 1950–89, from U.S. Department of Defense, *National Defense Budget Estimates for FY 1990/91* (Washington, D.C.: Office of the Assistant Secretary of Defense (Comptroller), 1989).

30. Employment loss in 1963–78 from Steve Schofield, "Employment and Security - Alternatives to Trident. An Interim Report," Peace Research Reports No. 10, University of Bradford, U.K., July 1986; 1978–86 job losses from John Lovering, "Arms Conversion into the 1990s: The British Experience," paper presented at conversion conference in Cortona, Italy, April 22, 1989; Fabrizio Battistelli and Liba Paukert, "Regional and Occupational Dependence on Defence Contracting in the Rome Area," Disarmament and Employment Program, Working Paper No. 9, International Labour Office, Geneva, 1988.

31. Michael Closson and Richard Williams, "Transforming Military Bases," *Ploughshare Press*, Winter 1989. In 1985 dollars, $1 billion spent on pollution con-

trol would create 19,547 jobs; in 1989 dollars, the same nominal amount would generate 22,200 jobs; Worldwatch Institute, based on Roger H. Bezdek et al., "The Economic and Employment Effects of Investments in Pollution Abatement and Control Technologies," *Ambio*, Vol. 18, No. 5, 1989. Other job creation potential from William Hartung, *The Economic Consequences of a Nuclear Freeze* (New York: Council on Economic Priorities, 1984), translated into 1989 dollars by author. West German data from Peter Wilke and Herbert Wulf, "Manpower Conversion in Defence-Related Industry," Disarmament and Employment Program, Working Paper No. 4, International Labour Office, Geneva, 1986.

32. For a discussion of the implications of the question "conversion to what?" see Michael Renner, "Conversion to a Peaceful Economy. Criteria, Objectives, and Constituencies," in Dumas and Thee, *Making Peace Possible.*

33. CBO estimate from "The Peace Economy." Decline in grant programs from Richard B. Du Boff, "What Military Spending Really Costs," *Challenge*, September/October 1989. The Conference of Mayors study found a net gain of 6,600 jobs, on average, for every $1 billion shifted from military spending to the examined urban programs; over five years, the proposed transfer of $150 billion would generate close to 1 million jobs *more* than the same amount spent in the military sector would have created; Employment Research Associates, *A Shift in Military Spending to America's Cities*, Report Prepared for the U.S. Conference of Mayors (Washington, D.C., and Lansing, Mich.: 1988).

34. Heiner Heseler and Rudolf Hickel, "Wirtschaftskrise, Wirtschaftsdemokratie und Vergesellschaftung," in Heiner Heseler and Rudolf Hickel, eds., *Wirtschaftsdemokratie gegen Wirtschaftskrise* (Hamburg, 1986), cited in Peter Wilke, "Rüstungskonversion—Wirtschaftspolitische Konzeptionen und Instrumente," University of Hamburg, unpublished draft, September 1989.

35. Lovins and Commoner advised workers' alternative use committees in St. Paul, Minnesota, and Kiel, West Germany, respectively; Mel Duncan, "Union to Unisys: Convert Now," *The Minnesota Peace Economy News*, Winter 1990; Herbert Zeretzke, Krupp MaK works council, Kiel, private communication, November 4, 1989.

36. Trade-offs between military and environmental projects from Renner, *National Security: The Economic and Environmental Dimensions.*

37. Worldwatch estimate of U.S. pollution control employment based on Bezdek et al., "The Economic and Employment Effects of Investments in Pollution Abatement and Control Technologies." The authors calculate that business investment for pollution control (12 percent of total U.S. spending for environmental protection in 1985) created some 167,000 jobs. Assuming that the remaining 88 percent of expenditures has a similar employment effect, the number of jobs would total just under 1.4 million. European Community estimate from Werner Schneider, "Arbeit und Umwelt," in Lothar Gündling and Beate Weber, eds., *Dicke Luft in Europa* (Heidelberg, West Germany: C.F. Müller, 1988).

38. David Bonavia, "Deng's Military Build-Down," *Far Eastern Economic Review*, August 22, 1985; Sydney Jammes, "China," in Ball and Leitenberg, eds., *The Structure of the Defence Industry*.

39. The 1990 military budget was reportedly increased by as much as 15 percent, apparently to reward the armed forces for their loyalty in the crack-down; Nicholas D. Kristof, "China's Army is Cared for in a Lean Budget," *New York Times*, March 22, 1990; Daniel Southerland, "China Increases Spending on Military by 15 Percent," *Washington Post*, March 21, 1990.

40. ACDA, *World Military Expenditures and Arms Transfers 1988*; Michael Renner, "Swords Into Consumer Goods," *World Watch*, July/August 1989; 20 percent procurement cut from Henry S. Rowen, "Gorbachev's Best Defense is Less Defense," *Wall Street Journal*, September 29, 1988. (The Central Intelligence Agency, however, recently estimated that China's military procurement budget had fallen by only 10 percent since 1978; "The Chinese Economy in 1988 and 1989: Reforms on Hold, Economic Problems Mount," Report by the Central Intelligence Agency presented to the Subcommittee on Technology and National Security of the Joint Economic Committee of the U.S. Congress, July 7, 1989.)

41. Third Front military factories from C.Z. Lin, "Employment Implications of Defence Cutbacks in China," Disarmament and Employment Program, Working Paper No. 14, International Labour Office, Geneva, 1989. (The First Front consists of China's coastal provinces; the Second Front is the inland provinces immediately adjacent to the coastal areas.) Dislocation from Jammes, "China."

42. Sydney Jammes, "Military Industry," in G. Segal and W. T. Tow, *Chinese Defense Policy* (London: MacMillan, 1984); Jammes, "China"; Richard J. Latham, "People's Republic of China: The Restructuring of Defense-Industrial Policies," in James Everett Katz, ed., *Arms Production in Developing Countries* (Lexington, Mass.: Lexington Books, 1984).

43. Latham, "People's Republic of China: The Restructuring of Defense-Industrial Policies"; "A Farewell to Arms Over Ten Years," *China Daily*, October 30, 1989; tax and credit policies from Lin, "Employment Implications of Defence Cutbacks in China"; Hua Di interview from "Tanks to TVs: Can China Succeed?" *Plowshare Press*, Winter 1990.

44. Rising civilian share and range of civilian products from "China Invents the Entrepreneurial Army," *Economist*, May 14, 1988; "Military Plant Goes Civilian," *China Daily*, November 23, 1987; Lu Yun, "War Industry Turns Out Civilian Goods," *Beijing Review*, August 3, 1987; "A Farewell to Arms Over Ten Years"; 1990 projection and classification of factories from Lin, "Employment Implications of Defence Cutbacks in China."

45. Lin, "Employment Implications of Defence Cutbacks in China."

46. Ibid.

47. "Tanks to TVs: Can China Succeed?"; Aeronautics and Astronautics Ministry from "The War Business Goes Civilian," *China Daily*, October 30, 1989.

48. Lin, "Employment Implications of Defence Cutbacks in China."

49. Apparently, 6 million persons in the armed forces have taken part in retraining programs since they were initiated in 1979; Liang Chao, "One Million Demobilized Servicemen Resettled," *China Daily*, September 2, 1989; Tai Ming Cheung, "Tinker, Tailor, Soldier," *Far Eastern Economic Review*, August 18, 1988.

50. "Spit and Polish Don't Cost Much," *Economist*, May 14, 1988.

51. Marta Dassu, "The Problem of Reconversion of the Military Industry: The Case of China," Occasional Papers No. 2, Center for the Study of International

Relations, Rome, 1988; share of military production exported from Michael Brzoska, "Abrüstung und Verstärkte Rüstungsexporte. Die Modernisierung der Chinesischen Verteidigungspolitik," *Der Überblick* (Austria), 2/1989; China's share of the international arms trade from Ian Anthony and Herbert Wulf, "The Trade in Major Conventional Weapons," *SIPRI Yearbook 1990*, Table 7.1. The Chinese military is forced to earn a growing amount of income from arms exports because the government's military budget covers only 70 percent of the PLA's total expenditures; Lin, "Employment Implications of Defence Cutbacks in China."

52. David Holloway, "The Soviet Union," in Ball and Leitenberg, *The Structure of the Defence Industry.*

53. Net savings from the INF Treaty after expenses for dismantling the missiles, launchers, and warheads; Remisov, "Disarmament Treaties and Conversion of Military Production in USSR."

54. Ibid.; Alexei I. Izyumov, "Soviet Economic Conversion," *The New Economy*, October/November 1989; Cooper, "The Soviet Defence Industry and Conversion."

55. "In Gorbachev's Words: 'To Preserve the Vitality of Civilization'," *New York Times*, December 8, 1988; for an overview of proposed European force reductions, see Randall Forsberg, "The Vienna Talks: Demilitarizing East-West Relations," *Defense & Disarmament Alternatives*, July/August 1989; for Soviet withdrawal from Eastern Europe, see Institute for Defense and Disarmament Studies, *The Arms Control Reporter 1990*, Section 407.E. The duration of the Soviet troop presence in East Germany is intricately linked to the controversy over whether a unified Germany will belong to NATO or be neutral; Serge Schmemann, "Soviets Unyielding on a New Germany in Western Orbit," *New York Times*, May 6, 1990.

56. Retraining plan from Leonid Vid, "Guns Into Butter, Soviet Style," *Bulletin of the Atomic Scientists*, January/February 1990; discrepancy between demobilized officers and housing from Izyumov, "The Demilitarization of the Soviet Economy"; adverse effects of troop cuts from Pear, "Economic Effect of Cutting Troops in Europe Assessed."

ter Gumbel, "Gorbachev Announces Spending on Soviet Military for

First Time," *Wall Street Journal*, May 31, 1989; overall arms production cut and Ryzhkov announcement from Michael Dobbs, "Soviets Admit Massive Deficit, Call for Defense Spending Cuts," *Washington Post*, June 8, 1989; 1991–1995 production cuts from Vid, "Guns Into Butter, Soviet Style"; reduction in military R&D from Anthony et al., "Arms Production."

58. Trade-off between military spending and housing construction from L. Veselovsky, Deputy Head of the All-Union Central Council of Trade Unions in Moscow, "Notes on the Discussions at the U.S.-U.S.S.R. Symposium on Conversion from Military to Civilian Economy," Moscow, June 14–16, 1984; environmental protection budget from Maria Welfens, "Umweltpolitik im Sozialismus: Diagnose, Analyse, Perspektive," in Kurt P. Tudyka, ed., *Umweltpolitik in Ost- und Westeuropa* (Opladen, West Germany: Leske & Budrich, 1988); schools from Alexei Izyumov, "Conversion. Is It Possible?" *New Times*, July 1988; infant mortality and life expectancy from Ruth Leger Sivard, *World Military and Social Expenditures 1989* (Washington, D.C.: World Priorities, 1989).

59. Alexei Kireyev, in the Soviet weekly *Ogonyok*, No. 19, May 1989, speaks of 345 military plants and 200 defense-related scientific research institutes to be converted (an English translation of this article appeared as "Ministry of Aviation and Macaroni?" *Bulletin of the Atomic Scientists*, January/February 1990). Leonid Vid, deputy chairman of the Soviet State Planning Committee Gosplan, writes "currently, 400 defense plants are being retooled to manufacture more civilian product"; Vid, "Guns Into Butter, Soviet Style." John Lovering of the University of Bristol talks about 200 firms involved; private communication, October 28, 1989. Conversion fund from Statement by Gert Weisskirchen, Member of Parliament, "Protokoll der Anhörung zur Rüstungskonversion," SPD Bundestagsfraktion, Bonn, March 2, 1989. Control of converted factories from Hans-Henning Schröder, "Versorgungskrise, Rüstungsabbau und Konversion in der UdSSR," Vol. 3, Berichte des Bundesinstituts für Ostwissenschaftliche und Internationale Studien, September 1989.

60. Civilian production in military plants from Paul Grenier with Eric Stubbs, "A Farewell to Arms? Soviets Rethink Defense Spending," *CEP Research Report*, Council on Economic Priorities, New York, April 1989; above-plan profit incentive from Central Intelligence Agency and Defense Intelligence Agency

(CIA/DIA), "The Soviet Economy in 1988: Gorbachev Changes Course," report presented to Subcommittee on National Security Economics, Joint Economic Committee, U.S. Congress, Washington, D.C., April 14, 1989.

61. CIA/DIA, "The Soviet Economy in 1988"; U.S. Department of Agriculture, Economic Research Service, *USSR Agriculture and Trade Report: Situation and Outlook Series*, Washington, D.C., May 1989.

62. Aviation industry's improvisation and Belusov quote from Diana Johnstone, "The Market for Plowshares," *Plowshare Press*, Autumn 1989; washing machine example from "Notes on the Discussions at the U.S.-U.S.S.R. Symposium"; TV example from "Weapons in Wonderland," in Sivard, *World Military and Social Expenditures 1989*; Vid, "Guns Into Butter, Soviet Style."

63. Failure to meet production targets from Statement by Gennadi Nikolayev, Higher Trade Union School, as recorded by Bischak, "International Roundtable Meeting: Survival of Civilization, Disarmament for Development, Conversion"; central selection of products from Horst Bacia, "Konversion Heißt Gorbatschows Motto für die Rüstungsindustrie," *Frankfurter Allgemeine Zeitung*, March 1, 1990.

64. Izyumov, "The Demilitarization of the Soviet Economy"; John P. Hardt, "Conversion or Chaos?" *Bulletin of the Atomic Scientists*, January/February 1990; Bacia, "Konversion Heißt Gorbatschows Motto für die Rüstungsindustrie."

65. Sergei Blagovolin, "A Pot Mustn't be Made of Gold," *Moscow News*, September 3, 1989; Izyumov, "Soviet Conversion"; questions of data access and oversight from Hardt, "Conversion or Chaos?"

66. Paddy Ashdown, "What Do You Do With Redundant Soldiers?" *The Guardian* (London), November 28, 1989.

67. Ad hoc conversion from Izyumov, "The Demilitarization of the Soviet Economy"; conversion draft law from Nikolayev, as recorded by Bischak; organizational arrangements and public discussion from Izyumov, "Soviet Economic Conversion."

68. Imposition of the Soviet procurement system from Stephan Tiedtke,

"Czechoslovakia," in Ball and Leitenberg, *The Structure of the Defence Industry.*

69. ACDA, *World Military Expenditures and Arms Transfers 1988.* The *SIPRI Yearbook,* which tabulates only the exports of major military equipment, registers Czechoslovakia as the seventh largest exporter, 1985–89, but Poland does not appear on a list that tallies the 15 leading arms peddlers. See Anthony and Wulf, "The Trade in Major Conventional Weapons."

70. Charlotte Saikowski, "Warsaw Pact Rushes to Trim Troops," *Christian Science Monitor,* February 8, 1989; Alan Riding, "At Conference, Soviet General Sees Changes in Warsaw Pact," *New York Times,* January 18, 1990; Hungary from "Blick auf die Landkarte," *Der Spiegel,* No. 49/1989.

71. Jaromir Sedlak, "Economic Conversion in Czechoslovakia: Collecting the Peace Dividend," paper presented at the 31st Annual Convention of the International Studies Association, Washington, D.C., April 10–14, 1990; Prof. Ladislav Iványek, Brno, Czechoslovakia, private communication, April 6, 1990.

72. Arms export share from Sedlak, "Economic Conversion in Czechoslovakia"; Craig R. Whitney, "Prague Arms Trade to End, Foreign Minister Says," *New York Times,* January 25, 1990; for a skeptical view, see Jonathan C. Randal, "Czechoslovakia's New Age: A Farewell to Arms," *Washington Post,* February 11, 1990.

73. Sedlak, "Economic Conversion in Czechoslovakia." The Research Center for Peace and Disarmament at the Academy of Sciences, the only research institute that studied conversion issues, was disbanded in January 1990; Iványek, private communication.

74. Regional distribution of arms-producing enterprises from Iványek, private communication; Tiedtke, "Czechoslovakia"; Anthony et al., "Arms Production"; Martin company example from Sedlak, "Economic Conversion in Czechoslovakia."

75. Anthony et al., "Arms Production."

76. Christopher Bobinsky, "Polish Arms-Makers Look for Sales in Plough-Shares Market," *Financial Times,* November 8, 1989; Anthony et al., "Arms Production."

77. Engelhardt and Rechtziegler, "Rüstungskonversion - Neue Dimension und Herausforderung"; Tiedtke, "Czechoslovakia."

78. "Präsenzstärke der NVA Halbiert," *Süddeutsche Zeitung*, January 27, 1990; Gera plant from "Zeiss-Zweigbetrieb Stellt auf Zivilproduktion um," *Süddeutsche-Zeitung*, December 15, 1989, and "Carl Zeiss Jena Rüstet jetzt ab," *Süddeutsche Zeitung*, December 28, 1989.

79. David E. Rosenbaum, "Pentagon Spending Could be Cut in Half, Ex-Defense Officials Say," *New York Times*, December 13, 1989; Patrick E. Tyler, "Study Suggests Halving Defense Budget in 10 Years," *Washington Post*, November 21, 1989.

80. Relative size of U.S. military economy from "No Business Like War Business," *The Defense Monitor*, Vol. 16, No. 3, 1987; recent military industry job losses from David C. Morrison, "Cushions for Contractors," *National Journal*, January 13, 1990; DRI forecast from Scott Armstrong, "Turning US Defense Pink Slips Into Payoff," *Christian Science Monitor*, January 25, 1990.

81. Job losses in Europe from Anthony et al., "Arms Production." Exports account for over half of total arms production in Belgium and for 85 percent in Austria; Adam, "L'Industrie d'Armement en Belgique"; Alexander van der Bellen et al., "Rüstungskonversion in Österreich," study commissioned by the Ministry for Science and Research, Vienna, October 1985.

82. European Trade Union Institute (ETUI), *Disarmament and the Conversion of Arms Industries to Civil Production. A Review of Possibilities and Experiences in Western Europe* (Brussels: 1983); Statement by Jean Louis Naudet, Confédération Generale du Travail, as recorded by Bischak, "International Roundtable Meeting: Survival of Civilization, Disarmament for Development, Conversion"; French idle capacity from Jacques Fontanel, "The French Arms Industry and its Present Problems," Centre d'Études Defense et Sécurité Internationale, Université des Sciences Sociales de Grenoble, France, February 1989; Ernst Gülcher, Flemish Peace University, Ghent, Belgium, private communication, January 2, 1990; Austrian situation from Klaus Schomacker et al., "Sichere Arbeitsplätze und Nützliche Produkte," *Militarpolitik Dokumentation*, Vol. 8, No. 39/40, 1984, and from Max Deml, "Aktion Umrüstung. Initiativen zur Rüstungskonversion in Österreich," *SzP*, 1/1987; Peter van de Veer, OSACI

(Ecumenical Study and Action Center on Investments, an interfaith group), Utrecht, private communication, October 30, 1989; Pieter van Rossem, Pax Christi Nederland, The Hague, private commuication, October 31, 1989.

83. States with current or pending legislation include California, Colorado, Connecticut, Florida, Maine, Maryland, Massachusetts, Minnesota, Pennsylvania, Vermont, and Washington; Michael Closson, Executive Director, Center for Economic Conversion (CEC), "State Level Strategies for Economic Conversion and Diversification," paper presented to the National Conference of State Legislatures, Boise, Idaho, April 20, 1990; Mel Duncan, "Legislature Considers Crucial Economic Conversion Bills This Session," *The Minnesota Peace Economy News*, Winter 1990.

84. Wilbur Maki et al., *Military Production and the Minnesota Economy* (St. Paul, Minn.: Minnesota Task Force on Economic Conversion, 1989); *Massachusetts and Its Military Industry*, Jobs With Peace campaign, from "Bay State Study," *Plowshare Press*, Summer 1987; Martin Melkonian and Russell M. Moore, *Cutbacks in Defense Spending: Outlook and Options for the Long Island Economy* (Hempstead, N.Y.: Business Research Institute, Hofstra University, 1989); Lori Park, "Finding Common Ground in Tacoma," *Plowshare Press*, Winter 1989; Bill Patz, "Northwest Conversion Planning," *Plowshare Press*, Spring 1989.

85. International Association of Machinists from Hartung, *The Economic Consequences of a Nuclear Freeze*, and from "Labor and Conversion," *Economic Notes*, February 1986; Jennifer Adibi, "Legislative Labor Pains," *Plowshare Press*, Summer 1989; "Labor Leads," *Plowshare Press*, Spring 1990.

86. UNiSYS is the result of a 1986 merger between the Sperry and Burroughs corporations, after which more than 5,000 jobs were lost in Minnesota; Mel Duncan, "Reversing the Current," *Plowshare Press*, Summer 1989; Duncan, "Union to Unisys."

87. Thomas B. Cochran et al., *Nuclear Weapons Databook. Vol. III: U.S. Nuclear Warhead Facility Profiles* (Cambridge, Mass.: Ballinger Publishing Co., 1987); U.S. Department of Energy, Office of Industrial Relations, "Contractor Summary Report by Contractor Classification," various editions; Greg Bischak, "Facing the Second Generation of the Nuclear Weapons Complex: Renewal of the Nuclear Production Base or Economic Conversion?" in Dumas and Thee,

Making Peace Possible; William Charland, "Converting to Non-Defense: Hi-Tech Los Alamos Seeks New Peacetime Industries," *Christian Science Monitor,* November 29, 1988.

88. Office of Economic Adjustment, *1961–1986: 25 Years of Civilian Reuse. Summary of Completed Military Base Economic Adjustment Projects* (Washington, D.C.: 1986); Robert Krinsky, "Community Programs Aid the Pentagon," *Bulletin of the Atomic Scientists,* October 1986.

89. Michael R. Gordon, "Military Services Proposing Slashes in Existing Forces," *New York Times,* May 12, 1990; job losses from base closures from U.S. Congressional Budget Office, "Past Base Closures and Realignments: Costs and Savings," Staff Working Paper, Washington, D.C., February 1989; proposals concerning the additional 48 bases from Michael R. Gordon, "Cheney Would Cut Divisions in Army But Maintain B-2," *New York Times,* January 30, 1990.

90. Chanute and Pease AFBs from Patrik Jonsson, "City Copes With Airbase Closing," *Christian Science Monitor,* January 8, 1990; Alameda County from Jane Gross, "Base Closings Seen as Opportunity Inside Problem," *New York Times,* February 4, 1990; base contamination from Nancy Herndon, "Switch to Industrial Parks Works," *Christian Science Monitor,* July 7, 1989, and from Lenny Siegel, "Coping With Toxic Cleanup," *Plowshare Press,* Spring 1990.

91. For an overview of current conversion initiatives, see CEC, "Conversion Organizer's Update," Mountain View, Calif., various issues; National Commission's recent activities from "Special Issue: The National Town Meeting," *The New Economy,* May 1990, and from Sandra Sugawara, "Disarmament Message Finds Converts on Capitol Hill," *Washington Post,* May 2, 1990.

92. History and goals of the campaign from "A Healthy Economy in a Peaceful World" (flyer), National Jobs With Peace Campaign, Boston, undated; Frank Clemente, Jobs With Peace Washington office, private communication, February 3, 1987; Lisa Peattie, "Economic Conversion as a Set of Organizing Ideas," *Bulletin of Peace Proposals,* Vol. 19, No. 1, 1988.

93. U.K. military spending (in fiscal year 1986/87 prices) grew from 15.6 billion pounds (1 pound, at 1987 exchange rates, equals $1.87) in 1978/79 to a peak of

18.8 billion pounds in 1985/86, but then declined to 17.5 billion in 1988/89; Quigley, "The Opportunity of Disarmament." Lovering, "Arms Conversion into the 1990s: The British Experience." The most comprehensive account of the Lucas campaign can be found in Dave Elliott and Hilary Wainwright, *The Lucas Plan - A New Trade Unionism in the Making?* (London: Allison and Busby, 1982).

94. TUC from ETUI, *Disarmament and the Conversion of Arms Industries to Civil Production*; Transport and General Workers Union (TGWU), *A Better Future for Defence Jobs. A TGWU Strategy for Arms Conversion* (London: 1983); Lovering, "Arms Conversion into the 1990s: The British Experience"; local conversion committees from Ron Todd, "Defend Defence Workers," introductory paper at March 1987 TGWU Eastbourne conference, published in TGWU, *Arms Jobs Conversion—a TGWU Report* (London: 1988), and from Jim Barnes and John Chowcat, "Arms Conversion—from Words to Action," *Sanity*, March 1987.

95. Tom Woodhouse et al., "Arms Conversion and the Defence Industry in the United Kingdom. A Review of Recent Developments," in Dumas and Thee, *Making Peace Possible*; ETUI, *Disarmament and the Conversion of Arms Industries to Civil Production*; Labour Party, "Defence Conversion and Costs," Statement of the National Executive Committee passed by the Labour Party Conference, October 1986.

96. Labour Party, "Meet the Challenge, Make the Change. A New Agenda for Britain," Final Report of Labour's Policy Review for the 1990s, London, 1989; Paul Quigley, Coventry Alternative Employment Research, private communications, March 15 and May 22, 1990.

97. Woodhouse et al., "Arms Conversion and the Defence Industry in the United Kingdom"; Paul Quigley, "Conversion in the United Kingdom: A Review of Recent Developments," *The New Economy*, October/November 1989; "Arms Conversion. A CAAT Briefing," *CAAT Newsletter* (Campaign Against the Arms Trade), London, July 1989.

98. Lovering, "Arms Conversion into the 1990s: The British Experience"; Quigley, private communication.

99. Attitudes of Christian Democrats, Social Democrats, and Greens toward conversion from Wilke and Wulf, "Manpower Conversion in Defence-Related

Industry"; SPD working group from Eckhard Fischer, Office of Gert Weisskirchen, Social Democratic member of the West German Bundestag and Chair of SPD Conversion Working Group, private communication, November 3, 1989; SPD program pledge from Burckhard Huck, Institut für Medienforschung und Urbanistik (IMU), Munich, private communication, March 13, 1990.

100. Schomacker et al., *Alternative Produktion Statt Rüstung.*

101. Ursula Richter and Manfred Zitzelsberger, "Vom Tornado in die Umwelttechnik," *Die Mitbestimmung*, December 1989; MBB Energie- und Industrietechnik, press release, August 2 1989; "Umwelttechnik im Textilviertel. Abwassertechnische und Energietechnische Innovation Augsburger Industriebetriebe," Programm zur Umweltverbesserung und Ressourcenschonung MBB-Stadt Augsburg, August 1989; Martin Grundmann, IMU Institut, Munich, private communication March 5, 1990 (the staff of IMU Institut serve as scientific advisors to the PUR project).

102. FNP co-founder Hinrich Krey, private communication, November 4, 1989; Hinrich Krey, "Der Förderverein Neue Produktion e.V. zu Kiel," Kiel, November 22, 1988; FNP newsletter, various editions; "Kieler Fahren im Expreßtempo in die City," *Kieler Nachrichten*, May 26, 1989.

103. Klaus Mehrens, "Alternative Produktion und Gewerkschaftliche Politik," *Die Mitbestimmung*, April/May 1984; Schomacker et al., *Alternative Produktion Statt Rüstung.*

104. Christian Wellmann, *Abrüstung und Beschäftigung-ein Zielkonflikt?* (Frankfurt and New York: Campus Verlag, 1989); Marc Fisher, "W. German Cabinet Approves 20% Troop Cut," *Washington Post*, December 7, 1989; Social Democrats' position on troop strength from Herbert Wulf, SIPRI, oral presentation at "Quo Vadis, Conversion?" workshop, University of Uppsala, Sweden, March 28, 1990.

105. Employment and foreign troops' demand from Wellmann, *Abrüstung und Beschäftigung - ein Zielkonflikt?* Thomas Vajna of the Institute for the German Economy in Cologne has calculated that U.S. troops' demand for goods and services from the West German economy totals $4.2 billion; Pear, "Economic Effect

of Cutting Troops in Europe Assessed." Troop reductions from West Germany from R.W. Apple, Jr., "Bush's Quandary on Forces in Europe," *New York Times*, February 2, 1990, and from Social Democratic Party (SPD) of Baden-Württemberg, "Baden-Württemberg im Abrüstungsjahrzehnt: Notwendigkeiten einer Aktiven Umgestaltungspolitik," Stuttgart, March 14, 1990, mimeographed.

106. Wellmann, *Abrüstung und Beschäftigung-ein Zielkonflikt?*; Rheinland-Pfalz study from Olaf Achilles, "Militärische Belastungsanalysen und Regionale Konversion. Kommunale Instrumente für eine Abgerüstete Region," Master's Thesis, University of Dortmund, 1990; infrastructure program from Joachim Weidemann, "Kungeleien um Stillgelegte Militärgelände?" *TAZ*, February 7, 1990, and from "Die Landesregierung Stellt sich auf Schließung Weiterer Stützpunkte ein," *Frankfurter Allgemeine Zeitung*, January 31, 1990; Schleswig-Holstein from Prof. Jörg Huffschmid, University of Bremen, private communication, April 5, 1990, and from Herbert Wulf, SIPRI, private communication, March 16, 1990; Wolfgang Grotheer, "Satzung der Bremischen Stiftung für Rüstungskonversion und Friedensforschung," Bremen, June 20, 1989.

107. Conversion legislation from Huck, private communication; Munich activities from Achilles, "Militärische Belastungsanalysen und Regionale Konversion"; press releases by the Working Committee for Arms Conversion (Arbeitsausschuß Rüstungskonversion), Munich; "Weniger Waffen Dürfen nicht zu Weniger Arbeitsplätzen Führen," press release by the SPD Munich City Council Fraction, January 19, 1990; "Zur Rüstungskonversion und Truppenreduzierung: Sofort 'Runden Tisch' Einrichten!" press release by Die Grünen im Münchener Rathaus, January 31, 1990; Werner Ringelmann and Inés Berber, "Eine Öko-Stadt Soll aus dem Boden Schießen," *Münchner Stadtanzeiger*, March 8, 1990; SPD Baden-Württemberg, "Baden-Württemberg im Abrüstungsjahrzehnt."

108. Size of the military industry and the end of its expansion from Rossi, "Italy," in Ball and Leitenberg, *The Defence Industry*; Battistelli and Paukert, "Regional and Occupational Dependence on Defence Contracting in the Rome Area"; arms exports from ACDA, *World Military Expenditures and Arms Transfers 1988*.

109. Mario Pianta, "Conversion in Italy," *The New Economy*, October/November 1989; Alberto Castagnola, Director, Archivio Disarmo, Rome,

private communication, November 11, 1989.

110. Castagnola, private communication; joint statement from "Industria Bellica. FIM, FIOM, UILM, per la Riconversione," *Meta*, May/June 1989.
111. Castagnola, private communication; Elio Pagani, Aermacchi shop steward, Milan, private communication, November 14, 1989.

112. Private communications with staff members of Archivio Disarmo, Rome, November 10, 1989. For an overview of the activities of the "military industry observatories," see "Weapons Watching? Si Grazie!" *Lettera del Coordinamento Nazionale degli Osservatori sull'Industria Militare*, November 1989.

113. Rome area study from staff of Archivio Disarmo, private communications (the findings are contained in a detailed report, "Ipotesi di Riconversione per l'Industria Elettronica dell'Area di Roma," Archivio Disarmo, Rome, November 1989); Rodolfo Ragionieri and Giuseppe Catalano, Forum per i Problemi della Pace e della Guerra, Florence, private communications, November 13, 1989; "Research Plan for the Second Stage of Inquiry into 'The Tuscan Military Industry and Possibilities for its Production Conversion'," Forum per i Problemi della Pace e della Guerra, Florence, English summary, October 1988.

114. Inga Thorsson, *In Pursuit of Disarmament. Conversion from Military to Civil Production in Sweden* (Stockholm: Liber Allmänna Förlaget, 1984); Utrikes-Departementet (Foreign Ministry), *En Politik för Nedrustning och Utveckling* (A Policy for Disarmament and Development)(Stockholm: Liber Allmänna Förlaget, 1988); Inga Thorsson, private communication, August 17, 1989.

115. Björn Hagelin, Military Adjustment Global Information Center, University of Uppsala, Sweden, private communication, May 9, 1990.

116. *Veckans Affärer* report described in Bengt Ljung, "Under the Gun: How Much Defense Can Sweden Afford?" *Sweden Now*, No. 2, 1989; "Bofors to Cut Jobs," *New York Times*, January 24, 1990; Björn Hagelin, "The Prospects for Conversion in Sweden," *The New Economy*, October/November 1989.

117. Daimler influence from Statement by Herbert Wulf, University of Hamburg, Klausurtagung der Arbeitsgruppe Rüstungskonversion, SPD-

Fraktion im Deutschen Bundestag, Bonn, June 14, 1988, and from Statement by Klaus Mehrens, IG Metall, in SPD-Bundestagsfraktion, "Protokoll der Anhörung zur Rüstungskonversion," Bonn, March 2, 1989; Daimler intention to reduce its military dependency from Marcus Breitschwerdt, in SPD Baden-Württemberg, private communication, February 26, 1990, from Maria Kielmas, "Wall Crumbles But Not Europe's Defense Industry Sales," *Christian Science Monitor*, January 4, 1990, and from Friedrich Bräuninger and Manfred Hasenbeck, "Musterknaben aus dem Osten," Editorial, *High Tech*, 3/1990; British situation from Susan Willet, independent conversion consultant, "Quo Vadis, Conversion?" workshop; Donald M. Kreis, "The Ploughshares Option," *Maine Times*, July 28, 1989.

118. Anthony and Wulf, "Arms Production"; Schomacker et al., *Alternative Produktion Statt Rüstung*; ETUI, *Disarmament and the Conversion of Arms Industries to Civil Production.*

119. Dutch efforts from Pieter van Rossem, "Ontwapening en Ontwikkeling: Op Dood Spoor," *Derde Wereld*, July 1986, and from Ludo Eijelkamp, *Konversie Kontouren* (The Hague: Pax Christi Nederland, 1985); Italian bills from Stella Righettini, "Quale Legislazione per la Riconversione delle Industrie a Produzione Militare. Strumenti e Risorse per una Politica di Diversificazione/Riconversione dell'Industria a Produzione Militare: Le Proposte di Legge in Parlamento," Forum per i Problemi della Pace e della Guerra, Florence, April 14, 1989. The arms export bill was passed by the Chamber of Deputies and now needs to clear the Senate hurdle; Sergio Andreis, Member of Parliament (Gruppo Parlamentare Verde), private communication, February 19, 1990.

120. H.R. 2852, proposed by Representatives Gejdenson and Mavroules, would provide very modest community assistance grants; H.R. 3999, offered by Representative Oakar, would set up a President's Council on Economic Adjustment; H.R. 4343, by Representative Matsui, would provide retraining for civilians at military installations; S. 2097, the Defense Diversification and Adjustment Act, has been introduced by Senator Pell; "Federal Update," *Plowshare Press*, Spring 1990; "Criteria for Conversion Legislation and Guide to Three Bills in the 101st Congress" (fact sheet), National Commission for Economic Conversion and Disarmament, Washington, D.C., July 1989. Most recent developments from Bill Zavarello, Office of Representative Weiss, private communication, April 19, 1990.

121. The Defense Economic Adjustment Council is to be composed of various cabinet members, including the Secretary of Defense, six management representatives from nondefense companies, and six union representatives; H.R. 101, "The Defense Economic Adjustment Act," 101st U.S. Congress.

122. Ibid. The bill used to contain a provision that made the receipt of defense contracts contingent upon a contractor's payment into the fund of an amount equal to 1.25 percent per year of the company's gross revenue on its military sales, but this has now been dropped in favor of a yet-to-be specified financing mechanism tied to cuts in military spending; Zavarello, private communication.

123. H.R. 101, Title 1, Sec. 102, paragraph 2.

124. Ann Markusen, "The Military Remapping of the United States," and John Lovering, "Islands of Prosperity: The Spatial Impact of High-Technology Defence Industry in Britain," both in Breheny, *Defence Expenditure and Regional Development*.

125. For West German Greens' demand for an EC-wide conversion fund, see Weidemann, "Kungeleien um Stillgelegte Militärgelände?"

126. "In Gorbachev's Words." The proposal to establish a U.N. clearinghouse was made at a gathering of conversion experts to prepare recommendations for policy initiatives by the U.N. Secretary General; see "Report of the Preparatory Meeting for the Panel Meeting of Eminent Persons, Disarmament/Conversion, Climate and Information Technology'," U.N. Centre for Science and Technology for Development, New York, September 1989, mimeographed. International Labour Office activities from Liba Paukert, "Methodology of Research and Implementation of Conversion from Military to Civilian Production," paper presented at conversion conference "Riconvertire per un Nuovo Sviluppo," Rome, November 3–5, 1988.

127. "Einzigartige Weltpremiere in München: 'Conversion '90:' Schwerter zu Pflugscharen," press release, Münchener Messe- und Ausstellungs-Gesellschaft (Munich Trade Fair and Exhibition Society), January 1990; Castagnola, private communication.

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