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How much should the Allies spend on military R&D?

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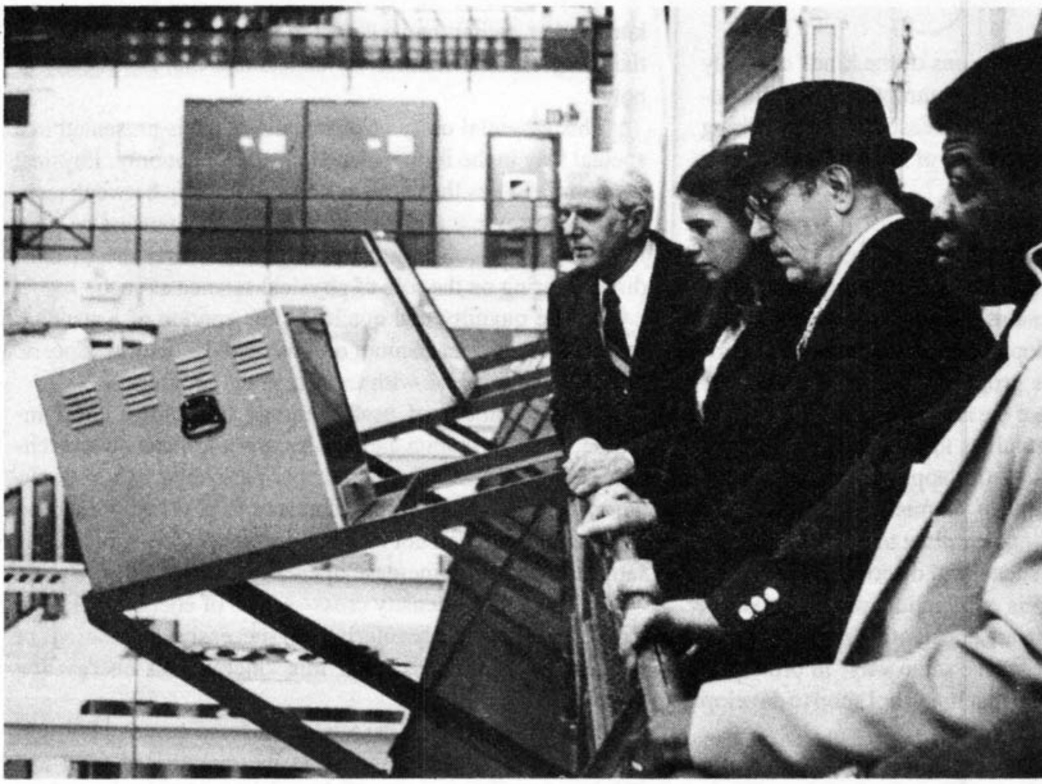
The 26 November 1986 report on "Civil Research and Development," by the Select Committee on Science and Technology of Britain's House of Lords (Her Majesty's Stationery Office, London, £6.00), reports in its conclusions, that "The Committee have found . . . a strong belief that the share of R&D expenditure devoted to defence (over 50 per cent) is too high."

The study of that report rounds out my own most recent round of studies of this subject, covering the cases for the U.S.A. and a number of its allies. With one notable exception, Japan, there is a lack of competent policy-making yardsticks at the level that government budgetary decisions are made, and no clear consensus on many of the subordinate, vital policy-issues involved, among the principal private industries, research centers, and so forth. Each nation, each general area of industry has its own special circumstances; nonetheless, the most important, common features of the problem require a new, common set of policy-shaping guidelines. Some among the most important of these problems belong to the area of my rather unique competence, the science of technology, physical economy.

In the instance cited from the House of Lords' report, for example, the Committee has missed the forest, the magnitude of total national research requirements, for the trees of seemingly conflicting priorities within the total. That, and other notable errors included within the report, are of the same sort we find in U.S. and other nations' wrangles over this and related matters. I go directly to stating policy guidelines which correct commonplace errors, without what seems to me a redundant and needless, nation-by-nation documenting of the occurrences of each among those errors themselves.

1) The fallacy of accounting approaches

I begin with the most general, and comprehensive of the errors to be considered. Admittedly, sooner or later, the accountants must be brought into the business of translating specifications for research and development allotments into the language of budgets. In determining what is required, and the magnitude of benefits expected, the standpoint of conventional accounting and financial budgeting practice must be excluded from the deliberations.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Lyndon LaRouche (wearing hat) and his wife Helga Zepp-LaRouche, on a tour of the Goddard Space Center in Maryland. "Generally, the most important technological military secret is the secret of producing advances as rapidly as they are discovered."

Economic processes have two very distinct aspects.

The matters of patterns of training and employment of the labor-force, of tangible investments in capacity, and the resulting changes in physical output and productivity, belong to the sphere of physical economy. In that sphere, money-prices and related financial matters are kept out of consideration. In physical economy, we consider only the content of per-capita market-baskets of households' and producers' goods as elements of cost and expense. All of the essential questions of research and development policy, military or other, belong entirely to the domain of physical economy.

A real economy is a physical economy, upon which are superimposed what are essentially political institutions, including currency, credit, and debt. Although, generally, these political features determine the purchases and sales of goods and services, there is no necessary correspondence between what a market does in steering flows of goods and services, and what those flows should be, if the best result were to be obtained. Intelligent governments and bankers shape their policies of taxation, currency, credit, and debt, and governmental purchases, in such a way as to influence the way in which the market prompts flows of goods and services to approximate a net desired effect. These actions by government are part of the establishment of a consensus, as to priorities, reached among governmental and private agencies. The study of the interaction between these political processes and physical economy, is called "political-economy."

The unfortunate thing, is that the very idea of the existence of physical economy seems unknown at the level of presenting and debating governmental budgetary allotments for defense, for research and development, and so forth. The production managements of the best firms do take physical-economy considerations prominently into account, but only partially. Even these valuable, if partial insights into these important matters, are little heard, and rarely understood among elected officials and their departments generally. Consequently, the most important considerations, which ought to shape policy-making for research and development, rarely come into view in the making of the final political decisions.

Case in point. Under present rules, U.S. defense contractors are obliged by government to do two extremely stupid things. First, even after the relevant example of the Challenger tragedy, vendors are more than discouraged from conducting research in areas bearing on the type of product they are producing. Second, when the contract is completed, the tools are destroyed!

Assume that the item produced is a combat aircraft, which suffers repairable structural damage. Alas! The jigs were destroyed, according to the rules! The U.S. government seems to have forgotten that maintenance is an integral part of capital acquisitions. Whether in aircraft or anything else, the two rules cited suffice to drive up the costs of procurement enormously. The second case is most easily understood. The costs incurred by government and industry because of the first policy-blunder, respecting research by defense suppliers, are vastly greater than the excessive costs caused by the more readily understood second.

These are very simple illustrations of the kinds of costly errors which result, when arbitrary assumptions of political-economy, and accounting, invade areas of policy-making which ought to be solely the province of technologic considerations.

2) The delusion of pure versus applied research

In well-organized scientific research at a university, the university's physics department, for example, maintains a machine-tool facility. The department head authorizes Professor X to proceed with a proposed line of experiment. Professor X goes to the head of the machine-tool facility, and works with the assigned specialists to produce the required experimental apparatus. "Pure" or "applied" research? The distinction is a meaningless bit of linguistic folly; the same procedure applies in the tooling of a plant to produce an item incorporating Professor X's successful discovery.

Technological progress, is production whose product-design and production-tooling are constantly being improved by scientists and their teams, in the same way, in principle, that Professor X works with the machine-tool shop to develop his experimental apparatus.

The problem of planning research allotment, is greatly simplified for us today, by the fact that the frontiers of scientific research and development are defined by four interconnected spheres of inquiry: 1) controlled plasmas, especially plasmas of extraordinarily high energy-density cross-section, typified by the case of controlled thermonuclear fusion; 2) coherent pulses of electromagnetic radiation, typified by lasers, especially those of very high energy-density cross-section of impact on target; 3) optical biophysics, the nonlinear electromagnetic spectroscopy of living processes; 4) the development of improved control devices, of the sort required to assist us in controlling even very complex (nonlinear) processes of very high energy-density cross-section at very high speeds of response.

These four areas of research impinge directly on every area of physical knowledge and production technologies. There is no known reason not to assume, that the overlay of these four areas will be the mainstream of every important revolution in materials, products, and so forth, for about 50 years or more yet to come.

The analysis of research-allotments policy, must take into account, that while physical science is very rich in growing complexity of its elaboration, it always remains intrinsically coherent. The division of the entirety of physical science, and production technologies, into compartmentalized specialties, does not signify that these branches are in any way actually self-contained specialties, but merely that an essentially unified body of physical science is being worked upon in terms of a division of labor among scientists generally. Naturally, we do not know everything about the laws of the universe, and perhaps never shall, but that is a defect in our knowledge, rather than a defect in physical laws. The essential unity exists, whether we understand that adequately or not.

This essential unity of physical science is presented in a special way in the framework of physical economy. Physical economy defines the cause-effect relationship between technological progress and increased productive powers of labor in terms of six constraints, among which three are of most direct bearing on the role of physical science as such.

1) The quantity and quality of the content of a standard market-basket, per-capita, of households' and producers' goods, must increase with technological progress.

2) The amount of usable energy consumed, must increase, both per-capita and per-square-kilometer, with technological progress. (Or, better, per per-capita unit of population-density.) Sustainable increases in physical productivity of operatives can not be achieved unless this constraint is satisfied. Call this "increase of energy-density."

3) The energy-density cross-section of energy applied to work, must increase secularly with successive generations of technological progress. Call this "increase of energy-flux density."

4) The percentile of the total labor force requried for rural production must decrease, while the quantity of food and fiber produced, per capita of the total population, increases. Call this "capital intensity in the first approximation."

5) The percentile of the urban labor force employed in production of producers' goods, including basic economic infrastructure, must increase, subject to the condition that per-capita output of households' goods' consumption increases. Call this "capital intensity in the second approximation."

6) Technology, as Leibniz defined "technology," must increase.

Respecting physical science, it is the correlation between advances in technology and increase of both energy-density and energy-flux density, which is decisive. Assuming that society acts in conformity with the other three constraints, increases in productivity will occur as a result of employment of advanced technologies, defined in terms of increases of both energy-density and energy-flux density. We measure the functional relationship in terms of fractions of orders of magnitude of increase of energy-density and energy-flux density. Standard physics and chemistry handbooks' tables point to the way in which such increases of energy-intensity revolutionize production.

So, to estimate the relative benefit of research and development, we need only assess the impact of the branch of research in terms of applied energy-density and energy-flux density made possible. What we measure is the research and development "pay-back" in physical-economic terms, a payback which is expressed as an increase in the productivity of operatives. For military applications, an increase of productivity assumes the battlefield guise of increase of firepower and mobility of forces.

Our object should always be twofold. Immediately, to bring the advantages ("pay-back") of physical research into generalized production as soon and as rapidly as possible. At the same time, to open up new stream-flows of fundamental breakthroughs bearing upon the known laws of physics, so that more advanced classes of applications to production shall become possible.

The assumption that there ought to be a compartmentalization of "pure" and "applied" research, is an illusion, albeit a rather popular one. As with most illusions, the penalty for imposing it upon our practice, is always folly, and sometimes devastatingly so.

3) The measurement of research allotments

Provided our science is good, the rate of scientific and technological progress, leading to increases in productivity of operatives, is essentially a function of the percentile of the total labor force employed as scientists, engineers, technicians, and so forth, in research and development. Five percent used to be a good ball-park figure; a goal of 10%, to be reached over the coming 10 years, would be a good one for today.

The rate at which the "pay-back" will be realized, is generally a function of the credit and tax incentives we supply to foster high rates of increase of capital-intensity and also turnover in existing capital stocks. If the economy is so organized, as to foster a high rate of technological attrition in designs of new products and productive processes, the economy will gobble up technological advances about as rapidly as our technologists develop them.

4) The fallacy of military versus civilian research

In the history of the rise of industrial society since Leonardo da Vinci's contributions to this, technological progress has usually occurred only at slow rates except as a by-product of military production. The disarmament buffs of the peace movements and "arms control" mafias, may find this fact an unpleasant one, but the fact that it displeases them does not make it one bit less true.

The chief reason for this seeming anomaly is elementary. In military procurement energized by fear of a capable potential adversary, improvements in mobility and firepower are at a premium. The factor of "investment risk" is at a relative minimum in making such decisions. So, the chief impetus for technological progress, and improved standards of living, in the civilian sector, has been the "spill over" of improved materials, machine-tools, and designs, from the sector of military production into civilian production.

The major among the secondary reasons for this seeming paradox, is that to the degree the rentier mentality, rather than the industrial-entrepreneurial one, dominates the institutions of credit, modern economies hold back the rate of technological progress, to levels far below those readily feasible, and clearly profitable, on the basis of designs in existence. Military procurement under conditions of pre-war or war-time mobilizations break that log-jam.

There is no real distinction between military and civilian research. The distinction between "military" and "civilian" arises only in respect to the choice of product produced employing the fruits of that research. Research is simply science, or the improvement of production technologies in a related way.

If we assume that the levels of employment in development of new technologies should be between 5% and 10% of the labor force's employment, then the military should fill the gap between the amount of such employment in the civilian sector, and the required level in total. The level of research and development is a matter of vital national interest, to such effect, that if the level needed is not reached in one way, it must be reached in another.

The idea of military research, as distinct from civilian, flows largely from the notion of "military secrets." The preoccupation with "technical military secrets" has been carried much too far, and ignorantly. By assigning ourselves, unnecessarily, too many things to be kept secret, we concentrate proportionally less effort, much less efficiently, on the smaller number of things which must be kept secret. The excessive growth of "secrecy" is largely a by-product of the fact that too little of our relevant scientific research is put into production.

Generally, the most important technological military secret is the secret of producing advances as rapidly as they are discovered. In that way, we should always be ahead of the potential adversary. The danger from an adversary, is not that he might acquire a technical "secret," but that he might succeed in producing something effective with that knowledge. Therefore, the more we hold back producing our advances in military-applicable knowledge, the more technical knowledge we oblige ourselves to keep secret. If our military procurement is operating at very high rates of technological attrition, much more than the Soviets could match, we have fewer technical secrets to worry about. Only a few items of strategic surprise are really worth technical secrecy; at least, this is the case under high rates of technological attrition in procurement.

Under high rates of technological attrition, it makes very little difference, in most areas of weapons-research, whether the weapon is a product of civilian or military research. To that degree, the two are interchangeable. The point is to have the desired levels of good quality research, in total, and an efficient stream-flow of discoveries into production.

5) The aerospace case

In the current, faddish revival of Smoot-Hawley lunacies, the United States has found itself in a bit of a quarrel with our European allies in the area of aerospace research and production. We may expect to hear some of the usual U.S. noises on the subject of Europeans' resort to the allegedly objectionable practice of "protectionism" in this compartment of production. They are, of course, quite "protectionist" in their continuing forms of cooperative efforts to keep a European aerospace industry in existence, and quite rightly so.

Do we wish the United Kingdom, West Germany, Italy, and France their sovereign right to have an aerospace capability, or do we seek, foolishly and arrogantly, to deny this to them? If we do, at what cost, and how well, shall we then maintain our military aircraft in the European theater?

The chief trouble with the Western world's aerospace industry is that foolish people believe it to be suffering a considerable excess in capacity. That is the accounting practice's point of view, and an absurd one. In reality, the total capacity of the Western world's aerospace capacity is pathetically small, relative to the needs coming up fast.

"Free trade," "supply and demand," and kindred ideological impedimenta are currently very much in vogue in Washington, but the fact that they happen to be policy at the moment, does not make these policies intelligent, nor even sane, any more than we could make the Moon a solid piece of green cheese by having the Congress enact a law requiring U.S. citizens to insist that it is. Destroying vital technological capabilities of our allies, for the sake of some mere piece of popularized superstition, "free trade," is not good service to any of the vital interests of the United States. It is not even consistent, to speak of the merits of "free competition," while using the name of such "free competition" to pare down the number of the world's producers to a monopoly by two superpowers.

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Our own aerospace sector, for example, has been bled almost dry, hovering at the brink of technological obsolescence for lack of re-capitalization. Why so? For one thing, "deregulation," aggravated by the decline in real per-capita income, has ruined the civilian airline industry, to the point that its fleets are becoming dangerously over-aged and maintenance stretched thin. But for these two factors, the airline fleets would have been turned over, with corresponding deliveries from the production of our aerospace industries.

Similarly, our recent and current development and production of military aircraft, is 10 to 15 years behind a tolerable backwardness in quality, and disastrously short of quantity. We have already passed the point, in terms of military technologies alone, that the most advanced military aircraft types in our inventories must partake more of the nature of aerospace equipment than aircraft as such.

In terms of cost per pound, there has been no fundamental improvement in rocket design since the German Peenemünde designs became established levels of technology during the 1950s. In getting into space from the Earth's surface, we are still trapped in what technological stagnation has made an absurd practice analogous to designing an aircraft to fly under water. The technological stagnation we have fostered in aerospace as a whole, is dominated by anomalies of this general type.

The popular, but absurd view of this industry, assumes that recent trends in sales, and marketing projections of a similar sort, define the magnitude of "need" as "visible demand." These trends have been determined chiefly by the combined effect of past policies of governments and financial institutions, policies which have been directed either to foster, or to adapt to, a transformation of modern industrial economies into "post-industrial" scrap-heaps of popular misery and strategic inferiority. Such estimates of "excess aerospace capacity," are analogous to the argument that the world is suffering a vast excess of food production, when in fact a growing, very large number of Americans are falling into a sub-standard diet, and famine conditions spread throughout much of the world's population as a whole.

The "excess of capacity," now popularly attributed to entire ranges of industries, is an estimate based upon an elementary folly, of confusing the nominal financial market for products, for the scale of unmet physical-economic needs. Governments and others, have become so obsessed with the wish to defend existing financial and related policies at all costs, that they would rather see a defectively managed "market" bring us all, mostly starving, under Soviet imperial overlordship, than change any among those financial and related policies now pushing the Western world into the worst depression since the 14th century.

Karl Marx's only genuine discovery in economics, was his appreciation, that if capitalist economies would resist all efforts to defy Adam Smith's "Invisible Hand," the victory of communism is assured. Naturally, Marx defended the "Invisible Hand" as the only policy which should be tolerated in capitalist society, and attacked the leading German economist, Friedrich List, and the leading American economist, Henry C. Carey, on precisely these grounds. On this point, we see today, that Marx was right. Adam Smith may not have intended to bring communist economies into world dominance, but we are at the point today, that such a consequence is immediately in front of us, unless we return to those "Colbertist" policies which U.S. Treasury Secretary Alexander Hamilton defined as the founding economic policies of the American System, "Colbertist" policies employed with some relative excellence and success, by the only Western industrialized economy "unfairly" not destroying itself, Japan.

From the standpoint of physical economy, there is a massive under-capacity in the combined aerospace industries of the Western allies. The entire industry is now hanging by a rotting thread of accumulated obsolescence, with shrinking cadres of qualified scientists, technicians, and skilled operatives. Present trends, if continued, mean that we shall soon lack the capacity even to maintain aerospace functions in the civilian and military sector at present levels of craft in use.

Agriculture put momentarily to one side, the recovery of the Western economies will depend chiefly upon three industries and their upstream vendors: aerospace, energy production and distribution, and shipbuilding. Shipbuilding is at the edge of collapse, perhaps more immediately endangered than aerospace. Industries in the domain of development and production of modern energy-systems, are in grave danger, chiefly because of bending to the demands of the lunatic "environmentalists." Of these three, the development of aerospace is the "science-driver" for any future recovery of our economies. The SDI, properly understood, and the more comprehensive adoption of a 40-year mission-assignment to plant a permanent, largely self-sustaining colony on Mars, subsume every advance in technology which mankind is likely to be able to accomplish during the next 50 years or more.

Over the past 20 years, we have destroyed NASA as the kind of functioning institution it used to be. All other facts taken into account, the essential fact about the Challenger disaster, was a combination of forced technological obsolescence imposed upon NASA, and a reduction of numbers of qualified personnel to less than a bare minimum. Our leading space-scientists, approximately 15 years ago, warned that the system built around the space-shuttle was an inherently defective one, and indicated the kind of alternate, more advanced system needed on these grounds. Our shuttle system is 15 years obsolete,
could have had operating by the end of the 1970s. At best, it will be about five years before we have the system we should have had at the end of the 1970s or even slightly earlier.

We are now obliged to build a new aerospace capability, to be what NASA should have become. The Mars colonization mission points the way. Every advance required for any purpose in aerospace capabilities, is subsumed by a Mars colonization mission. The next step, is to stop trying to build "an aircraft designed to fly under water": the next step into space, is a transatmospheric craft designed to reach low Earth orbit, the first stepping-stone for man's entry into space in a general way. Every military and other aircraft design we require for the next two generations, will be an offshoot of the development of new kinds of materials, new designs of engines, and so forth, required to produce an effective transatmospheric craft, and to move beyond that, to such items as a Mach-15 aircraft and more advanced space-craft. Every new technology likely to be needed and available during the coming 50 years, will be developed along that pathway of aerospace development.

In addition to new capitalization of the industry, our major bottleneck presently is the monstrous, deadly shortage of qualified cadres. If we combine the present aerospace resources of North America, Western Europe, and Japan, we have barely the minimum capacity and qualified personnel, to build up the industry to needed levels. Instead of fighting Japan and Western Europe, over the issue of taking in one another's aerospace laundry, we should be delighted that those governments are, in a sense, subsidizing the continued existence and marginal development of their parts of this industry. On the one side, we demand that those nations increase their defense allotments, yet we object when they actually do so, by subsidizing their aerospace capabilitiies.

Conclusion

The Western nations must establish a minimum of 5% of the total labor-force employed in research and development. The leading edge of this allotment must be in the four categories of ongoing technological breakthroughs indicated. This must be integrated with emphasis upon expansion and technological development of the aerospace, energy-systems, and shipbuilding industries, and those industries' up-stream sources of materials and semi-finished product. New directions in biological research will be centered in the development of the aerospace industry's optics divisions, where the needed instrumentation for optical-biophysics research is most readily and naturally to be developed, and this to an effect consistent with the foreseeable requirements of aerospace systems.

The medium-term goal for Japan, North America, and Western Europe, should be 10% of the total labor force employed in research and development. Educational and employment policies of industry and government must be efficiently addressed to achieving this result.

As much as possible, these employment goals must be reached within the private sector's industries. This must be fostered by government, through such channels as procurement policies, credit policies, and tax-incentives. Direct government grants to research should emphasize fundamental research at levels above those currently being employed in industrial development, or to supplement private research and development's allotments to the degree needed to bring total employment up to standard amounts.