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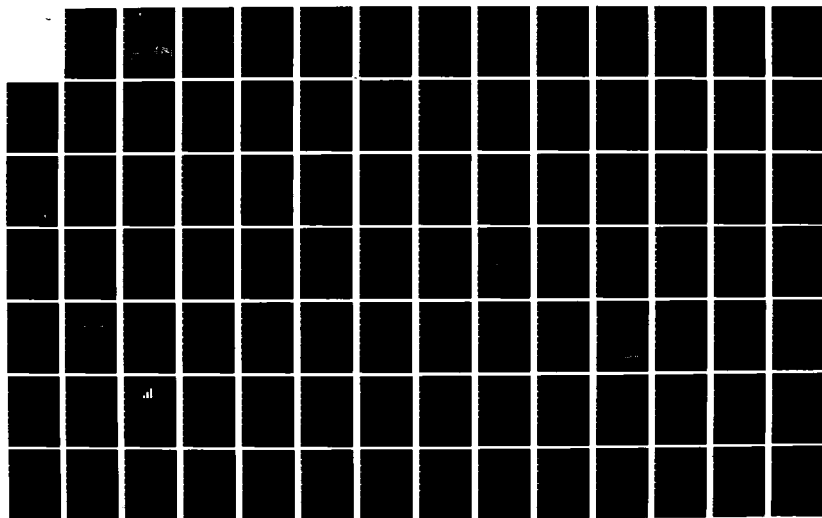
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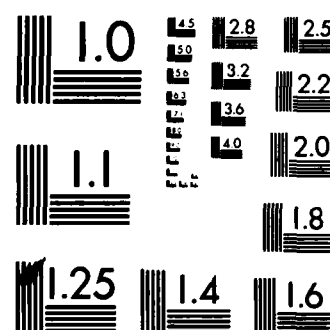
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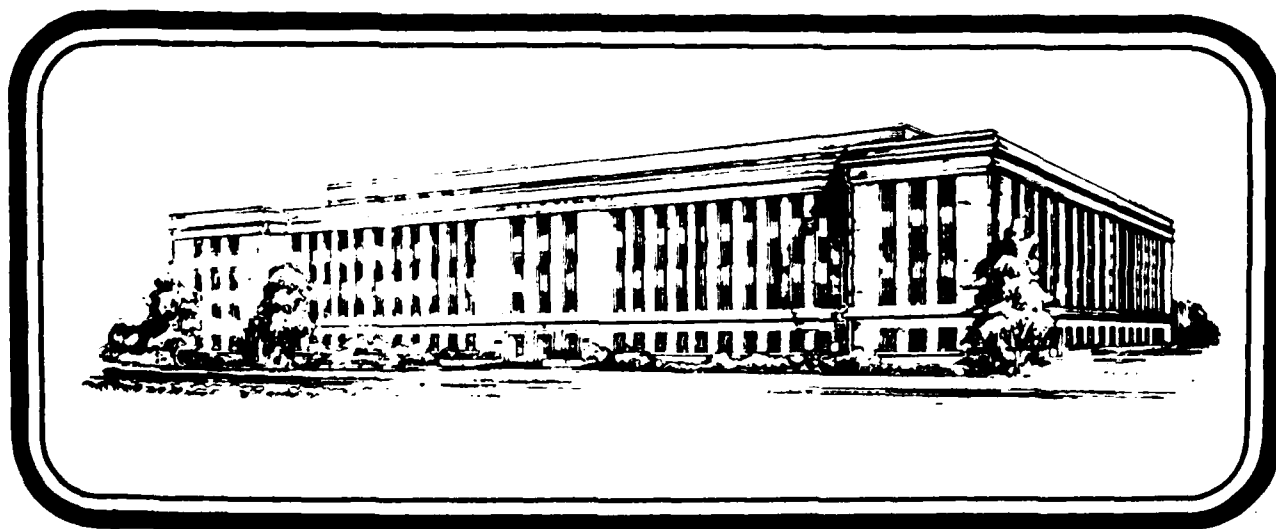
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**MOBILIZATION AND DEFENSE MANAGEMENT
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**MOBILIZATION STUDIES PROGRAM REPORT:
COORDINATED POLICY FOR THE
AIRCRAFT INDUSTRY**



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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NDU/ICAF 83/004	2. GOVT ACCESSION NO. AD-A23113	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MOBILIZATION STUDIES PROGRAM REPORT, COORDINATED POLICY FOR THE AIRCRAFT INDUSTRY		5. TYPE OF REPORT & PERIOD COVERED IR #6, AY 82/83
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) DAY O. MOUNT, DEPT OF STATE JOHN T. SLAUGHTER, JR., COL, USAF GEORGE F. UNGER, NASA, CURTIS J. WINTERS, CAPT, USN		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS INDUSTRIAL COLLEGE OF THE ARMED FORCES FORT LESLEY J. MC NAIR WASHINGTON, DC 20319		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS INDUSTRIAL COLLEGE OF THE ARMED FORCES FORT LESLEY J. MC NAIR WASHINGTON, DC 20319		12. REPORT DATE MAY 1983
		13. NUMBER OF PAGES 40
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) NATIONAL DEFENSE UNIVERSITY FORT LESLEY J. MC NAIR WASHINGTON, DC 20319		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) UNLIMITED APPROVAL FOR PUBLIC RELEASE		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) N/A		
18. SUPPLEMENTARY NOTES N/A		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) N/A		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) There are a broad range of government policies that affect the aircraft industry, yet there is no central focus for policy coordination. Crisis management results in ad hoc solutions to such diverse matters as trade, anti-trust and military procurement. Foreign competition aggressively and successfully pursues the world market. This may have critical implications for our economic well-being and national security. The success of aircraft industrial policy in Japan and France suggests that a structure for policy coordination is needed.		

THE INDUSTRIAL COLLEGE OF THE ARMED FORCES
NATIONAL DEFENSE UNIVERSITY

MOBILIZATION STUDIES PROGRAM REPORT
COORDINATED POLICY FOR THE AIRCRAFT INDUSTRY

by

DAY O. MOUNT, DEPARTMENT OF STATE
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GEORGE F. UNGER, NASA
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A RESEARCH REPORT SUBMITTED TO THE FACULTY
IN
FULFILLMENT OF THE RESEARCH
REQUIREMENT

RESEARCH SUPERVISOR: JOHN H. MCDADE, MAJOR, USA
THE INDUSTRIAL COLLEGE OF THE ARMED FORCES

MAY 1983

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ACKNOWLEDGEMENT

Several individuals made important contributions to this report. It is fitting that they be recognized for their unselfish efforts. Without them this report would be a much poorer product. We thank them.

Jack Steiner, The Boeing Company
Larry Jenkins, The Bell Helicopter Textron
Sally Bath, Department of Commerce
Steve Piper, Office of the Trade Representative
Bob Gelbard, Department of State

The authors would also like to thank Jane Slaughter who patiently translated scribbled copy into this typed paper.

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**ABSTRACT OF STUDENT RESEARCH REPORT
INDUSTRIAL COLLEGE OF THE ARMED FORCES**

NAME OF RESEARCHER (S) Day O. Mount, Dept of State John T. Slaughter, Jr., Col, USAF George F. Unger, NASA Curtis J. Winters, Capt, USN	TITLE OF REPORT Coordinated Policy for the Aircraft Industry
SECURITY CLASSIFICATION OF REPORT Unclassified	REPORT NUMBER M IR# 6

ABSTRACT

Problem Statement: There are a broad range of government policies that affect the aircraft industry, yet there is no central focus for policy coordination. Crisis management results in ad hoc solutions to such diverse matters as trade, anti-trust and military procurement. Foreign competition aggressively and successfully pursues the world market. This may have critical implications for our economic well-being and national security. The success of aircraft industrial policy in Japan and France suggest that a structure for policy coordination is needed.

Findings/Conclusions:

1. Commercial aircraft sales are important to national defense.
2. Commercial sales are threatened by foreign competition. Foreign governments either own, dominate or subsidize their aircraft industry. They actively use comprehensive, targeted policies to marshal resources for international competitiveness. Their success is increasing.
3. A lack of coherent government policies is costly and harms competitiveness.
4. It is not desirable to exactly duplicate the government-directed industrial policies of Japan and France in this country, but coordination is needed.

Recommendations: A government unit of ten persons or less should be established to host a forum for information exchange, sectoral forecasting and discussion of long-term policy implications. This unit should be permanent and report to the President and Congress. The objective should be to build a consensus for individual action by government agencies, legislative committees, companies, unions, banks, universities and the media. Actions to be considered should deal with research, technology innovation, procurement, trade, mobilization, taxes and other indirect subsidies, employment and training, and anti-trust. This paper suggests changes in many of these areas.

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EXECUTIVE SUMMARY

This paper investigates the need for a coordinated government policy for the aircraft sector and suggests what that policy might be. Four areas were researched: (1) the current state of the aircraft industry; (2) the range of existing policies that affect the industry; (3) staff studies of French and Japanese industrial policy and some lessons learned; (4) a case study of the Airbus Industries' success in the marketplace.

The aircraft industry is vitally important to the economic well-being and national security of this country. Civil aircraft sales constitute about half of the industry's yearly dollar volume and lead directly to cost-effective national security. Such business generates research funding that can have important military application. It also forms a critical part of the mobilization base. Its international sales are vital for commercial success and yield our second largest net export account, sustaining our national prestige and high standard of living.

Yet the industry faces grave challenges in its commercial markets from foreign competition that is either government owned, dominated or subsidized. This threat means not only loss of American jobs, but a loss of technical leadership and loss of a source of innovation for our entire industrial base. Indeed, American defense strategy relies on this technical leadership for military superiority on the battlefield.

The federal government has a diverse range of policy tools, laws, regulations and practices that affect the aircraft industry. Most of these were created in reaction to short term stimuli and without analyzing the long range implications. Moreover, there is no central focus for these policies and no forum to discuss their effect on national security and international competitiveness. The result is a lack of understanding of the broad issues and long term trends. This is particularly important for industries such as aircraft manufacturing, where policy initiatives take seven to ten years to generate change in new products. A different approach is needed.

The Japanese and French have a long history of coordinating government actions in broad industrial policies for indicative planning. These policies are pro-active in promoting trade, production efficiency, technical innovation and market strategy. Over the past 30 years, this approach has borne fruit in economic independence and growth. Failures have been many and in some cases spectacular. Yet in the long run the trends show overall success. It is apparent these countries have learned from their failures and have prospered. The recent recession and social and political policies cloud this picture for France, but that is not the subject of this paper. Other examples such as Korea or Taiwan could be used to show the success of industrial policy.

Nevertheless, one of the major conclusions of this paper is that it is not desirable or necessary to duplicate these foreign models in this country. Much has been written about the merits of broad national industrial policy and about the merits of specific industrial policies to increase productivity at the plant level. This study attempted to bridge these ideas and concentrate on a particular industrial sector that is highly wedded to government actions and crucial to national defense. The result is not a recommendation for a new bureaucracy, indicative central planning or direct market manipulation. Our study proposes a more democratic recommendation and one that is missing from the political landscape: a forum for broad industrial issues that can involve the forces of change both within and outside of government.

Since there is no consensus on a broad industrial policy for all of manufacturing, it would be foolish to detail the structure of this forum. Indeed, there is no Department of Industry, no Cabinet Council on Industry or even an advisor to the President on industry. Nonetheless, we can spell out the direction and intent this new forum might take in order to illustrate our conclusion:

1. **Organization:** a high level unit (of less than ten government employees) which hosts gatherings of interested parties, both private and government, and issues an annual report to the President and Congress.
2. **Purpose:** to provide a forum for information exchange, forecasting, and discussion of long-term policy implications.
3. **Objective:** to build a consensus for action that could be voluntarily undertaken by individual government and private entities.
4. **Goals:** maintain leadership in this technology, lower the cost and raise the quality of military products, promote trade, and stabilize production cycles (and therefore employment).
5. **Invited participation:** must include key policymakers drawn from the executive and legislative branches of government, companies and associations, and the banking and labor communities as well as observers from academe and the media.

In arriving at the conclusion that coordinated policymaking is needed, an agenda for policy change was assembled that might benefit the aircraft industry. The changes need not be targeted specifically to aircraft manufacturing, however. We feel such targeting may unnecessarily distort the marketplace. Nevertheless, the aircraft industry is particularly sensitive to certain broad policy areas that bear mentioning. The proposed government unit can act as a catalyst for change in these areas:

- a. In research the effectiveness of our national investment must be raised. We recommend: (1) stable and coordinated budgets without micromanagement, (2) streamlined contracting procedures to respond rapidly to new opportunities, (3) consolidation of research activities in the Department of Defense with peer review for quality control, and (4) tapping foreign research.
- b. In technology innovation, the fruits of research must be brought to the marketplace ahead of foreign competition. We recommend: (1) below market loans to incentivize capital flows in mature industries, and (2) banks be allowed to own equity shares in companies to promote structural change and long range planning.
- c. In government procurement, contracts must not be a millstone retarding productivity growth. We recommend: (1) practices more in line with commercial contracts, that is, fewer specifications and more objectives, and the ability to plan and recoup long term productivity investment, (2) creative dual source procurement especially at the subcontractor level, and (3) timed military procurements (where possible) to stabilize production cycles and employment.
- d. In government trade activities, efforts can no longer be passive and piecemeal. We recommend: (1) permanent coordination of trade activities to eliminate counterproductive policies, (2) proactive promotion to counter non-tariff barriers, and (3) negotiations for removal of those barriers.
- e. In anti-trust matters, government interpretations of anti-competitive practices must recognize the international nature of the marketplace. We recommend revision of the anti-trust laws to remove the political uncertainties of domestic joint ventures.

These recommendations, taken together, would give the American aircraft industry many of the advantages now enjoyed by the foreign competitors. More importantly, by establishing a permanent structure for coordinated policymaking, the national defense can benefit from less costly, higher quality military aircraft in the years to come.

CHAPTER I

INTRODUCTION

The economies of the world are undergoing rapid and profound change. Markets are international; jobs and capital flow freely across national borders. Low-wage countries capture the production of goods requiring unskilled labor and long production runs. In 1983, the United States finds itself no longer the dominant or dominating country economically. The survival of our economic well-being and military superiority now depends less upon products of material than "products of the mind." This survival cannot be left to chance.

Foreign governments such as Japan and France are determined to play a large role in securing their economic futures. Their industrial policies recognize that they are poor in natural resources but rich in human capital. These policies nurture and promote high technology industries such as biotechnology, chemicals, electronics, materials, optics, telecommunications and aerospace. Japan has set a goal to capture 15% of the worldwide aerospace business by the year 2010. They had set similar goals in automobiles and consumer electronics. In this climate, our aircraft companies face enormous challenges from foreign companies which, in most cases, are owned, dominated, or subsidized by their governments. This study analyzes these challenges and proposes an appropriate American response.

Why The Aircraft Industry?

It is unique. With the exception of the space business, no other major

manufacturing industry is so heavily tied to our national security - and so heavily influenced by government actions: regulation, procurement, direct and indirect subsidies. It is a special case under the General Agreement on Tariffs and Trade (GATT). Every country that has the resources to start a native aircraft industry has sacrificed to do so. New commercial products require the highest risk-capital-to-equity ratios with the longest lead times of any industry. Entry costs can exceed \$500 million (general aviation) to \$2 billion (jet airliners). Markets constantly shift and the financial condition of buyers fluctuate wildly - yet economies of scale are essentially to achieve profit.

It is easily studied. Facts and figures abound. There are easily countable numbers of companies and finished product models.

It is an industry with a future. It is international, high technology and knowledge-intensive. The market will double in ten years. Employment is high valued-added. Tasks that require low wage, unskilled labor cannot be easily exported. American companies are highly productive commercially and competitive on price, quality and performance.

Organization Of This Paper

In order that this paper be easily understood and analyzed, the findings, policy discussion and recommendations are presented in concise form as the body of report. The findings draw from conclusions developed in separate appendices. The appendices are the products of individual authors and bring together pertinent analysis that did not exist before under one cover.

CHAPTER II

ANALYSIS OF INDUSTRIAL POLICY FOR THE AIRCRAFT INDUSTRY

Basic Assumptions

The central theme of this research project is industrial policy. Foreign governments use it with apparent success and it may contribute a significant element in determining comparative advantage between two trading countries. It could also be called targeted supply-side economics for industry. The hypothesis is that such policy enables a country to efficiently marshal its resources, particularly in high technology growth sectors, to stimulate prosperity. That may mean subsidies or special legal considerations. But it does mean stimulating production through promotion of trade, lowering cost or rapidly creating new products.

Subsidizing one industrial sector is not without precedent in this country. Railroads, highways, space, housing, textiles, agriculture, oil and synfuels have all received preferential treatment, from tax relief to explicit funding at the federal level. Such direct and indirect subsidies were estimated to be \$304 billion in 1980, about 10% of the gross national product.¹ These subsidies constitute a tax on the general public so they should be carefully considered and subject to public evaluation.

In the area of trade, it is taken as axiomatic that relatively free trade can produce enormous economic benefits. Clearly then subsidizing industries to promote trade may be an appropriate policy for a country to insure prosperity. But what industries do you support? For purposes of this paper, it is assumed that trade industries that contribute significantly to the

national security and a high standard of living offer significant benefits to society as a whole and could be considered for special treatment. Stated as a set of criteria, we feel such industries (4 digit Commerce Code level) must satisfy all of the following:

1. Over 20% of total market value is purchased by the Department of Defense.
2. Its technology is essential for battlefield superiority.
3. It has high added value employment, not high wages per se.
4. Over 20% of commercial output is exported.
5. The predominant factors of production are not low wages or high usage of natural resources.

Aircraft manufacturing (airframes, engines and avionics) satisfies all of these criteria. Over 50% of the value of all aircraft manufactured is purchased by the Department of Defense. The superior technology of fighters, bombers and helicopters is essential to military strategy. Over 50% of the value of commercial output is exported. A Japanese study ² has shown that it contributes high added value as a percent of finished product value when compared to other industries. For example:

	<u>% Added Value</u>
Aircraft	44
General machinery	44
Domestic electrical products	38
Ship building	34
Steel making	29
Vehicles	25

The same study showed that aircraft manufacturing also has high value per unit weight:

	<u>\$ Per Pound</u>
Aircraft engines	280
Passenger aircraft	160
Cameras	100
Computers	50
Color televisions	10
Cars	1.8
Ships	.2

And conversely, it uses fewer natural resources and energy per production worker than steel, automobiles or ship building. The only other industry that scores higher in these areas is space. Unfortunately, very little output from space industries is exported to other countries.

A final axiom is that certain business can achieve international market predominance once they grow to a critical market share. This is particularly true where the re-entry cost is extremely high and not influenced by government funding. Thus a country's industrial policy can achieve huge gains for its native industry if other countries or businesses do not respond in kind. Apparently this has been the case for several sectors:

Japan: automobiles and consumer electronics

Korea: ship building

W. Germany: chemicals and pharmaceuticals

U.S: space and aircraft

In the aircraft sector the picture is now changing. Japan and France are "force-feeding" their aerospace sector in the face of a U.S. industrial policy that is but a melange of rudderless elements. The question for the U.S. is whether or not a coordinated industrial policy is appropriate for the aircraft industry and, if so, what that might consist of.

Arguments

As currently used, the words "industrial policy" are defined as the agenda for guiding the future of a particular industry. Declining industries are encouraged to decline "gracefully" or restructure themselves into other business segments. Growing industries are encouraged to accelerate their growth. This is made possible by a variety of financial, legal and structural inducements. The goal is increased prosperity for the general economy by targeting government actions to change market behavior.

Pro Arguments

Supporters of industrial policy reason that a comprehensive approach by government will marshal a country's resources in support of businesses that are "winners" while easing the transition for "losers." Although a mature industry, the aircraft sector is thought to be a "winner" based upon past performance and inherent characteristics. But that is not a certainty in a volatile international market. This industry needs the best possible perspective on long-term trends since research and development decisions do not yield profits for 6 to 12 years at a risk of most or all of the company's

equity. A coordinated policy can provide this perspective. Moreover, it can ensure better aircraft productivity for defense production and a competitive stance in the face of foreign industrial policy.

Con Arguments

Critics of industrial policy fear increased government meddling in the economy and a new bureaucracy to administer it. Besides it is argued, you cannot limit its application to one sector; the effects are just too complex to contain. Government bureaucrats cannot make decisions as well as investment bankers. A subsidy for one sector is a tax on the other. How can you pick "winners" beforehand? Besides, huge failures, such as the Anglo-French Concorde, point out the dangers of governments trying to second-guess the future. Furthermore, this country has no history of indicative planning similar to that in Japan and Europe.

Both arguments contain certain elements of truth. The government already "meddles" in the economy, but with no clear idea of what the overall, long-term effects that individual agency actions might have. Students of Japan's Ministry of International Trade and Industry (MITI) know that its bureaucracy of 2500 is small by any measure (see Appendix D). They also know that MITI is largely free from partisan politics. Furthermore, subsidies for one industry are not usually thought to be a tax on another industry, but on the taxpayers and therefore on consumption. As for the Concorde, it was a specific development decision like the U.S. supersonic transport and should not be used as a valid argument against having a coordinated, industry-wide policy. Bad development decisions can be made with or without industrial policy.

The remaining arguments against comprehensive policymaking deal with the loss of freedom and the difficulty of implementation given American cultural biases. Loss of freedom occurs when the government takes over choices that individuals currently control without a commensurate increase in electoral control. Indeed, the notion that markets and enterprise will no longer freely function is powerful rhetoric against industrial policy.

In the case of the aircraft industry, these arguments are blunted by the realities of the business today. The few remaining manufacturers constitute an oligarchy, not a pluralistic group of sellers. The Department of Defense and the major airline companies can be called an oligopsony, not an unrelated mass of consumers. Therefore, the market for aircraft can hardly be called free. Nevertheless, the individual companies do compete and have the potential to profit and the freedom to fail. Despite enormous government involvement they have a basic level of responsibility for their actions. There is free enterprise.

Recommendation - Coordinated Policymaking

A middle ground position is clearly indicated. A comprehensive policy is needed but it should not be coercive or particularly targeted. Much can be accomplished by providing an "industrial forum" for issues that are generated in the aircraft industry by broader government policies. Conversely, problems in the aircraft industry can lead to changes in policies that affect many industries.

There are many forms this "industrial forum" would take. Many organizations on the Washington scene provide examples for this new unit to adopt or avoid. As a result of interviews, readings and the collective experience of the authors, we have reached the following conclusions about this new unit:

1. It should be a prestigious entity, independent of any government agency and the political process.
2. Permanent staff should number less than ten.
3. This staff would monitor issues, chair meetings, prepare agendas and provide administrative support.
4. It should be permanent, hold regular meetings and issue a report to both the President and Congress.
5. Participants should be policymakers drawn from government agencies, White House staff such as the Office of Management and Budget, industry leaders, labor leaders and the banking community.
6. Participants must also come from Congress, possibly appointed by the Speaker of the House and Senate Majority Leader. Their involvement is crucial.
7. Invited observers should include business media, distinguished individuals and the academic community.
8. It should have the power to secure expert testimony and finance special studies.

This organization would embody the best organizational elements of such successful entities as the Federal Reserve Board, the Office of Technology

Assessment, the Cabinet Council on Commerce and Trade, blue ribbon panels, industrial trade associations, Presidential commissions, task forces, and Congressional Committees. However, this unit would have one additional feature:

9. It should build a consensus for action but take no specific action on any issue. Those actions that may be indicated by the group's consensus should be left to voluntary, separate choices taken by the individual participants such as Congress, companies, agencies, etc. They may choose to act independently or in concert.

An instructive model for this form of government operation exists at the National Aeronautics and Space Administration (NASA). Since NASA is not the end user of its aeronautics research, it works with special committees to review its programs and plans. They meet twice a year to discuss progress on research projects and future plans. The meetings are open to the public. Membership is drawn from industry, the Department of Defense, the Federal Aviation Administration and the university community. Discussions are lively. A consensus is hammered out and documented for the record. It is vaguely bureaucratic but it gets the job done. Information is exchanged. New ideas surface. Trends become evident. The government has accomplished what it does best: it has acted as a catalyst for the identification of solutions without the pale of coercive central planning. Each individual participant retains freedom of action, but faces the responsibility of his decisions as part of a team.

The NASA model is not unique in Washington. Numerous ad-hoc forums bring together experts for broad policy recommendations in the aircraft sector. One was recently completed by the Office of Science and Technology Policy; another has been started by the National Academy of Science. Unfortunately, none of these forums are permanent except NASA's committees. But not even at NASA do Congressional members, media, labor or banking interests participate.

We think the need for coordinated policy has been established and we have found a way to respond to that need with a uniquely American flavor. To illustrate what immediate agenda items might be considered by this new organization, we have highlighted some suggested policy changes that surfaced during our investigations. These are detailed in the following chapter.

FOOTNOTES

CHAPTER II (Pages 3-11)

¹Magaziner, Ira C. and Reich, Robert B., Minding America's Business (Harcourt Brace Publishers, 1982) p. 242.

²"Hi-Fi or Hi-Tech?", FLIGHT International Magazine, November 20, 1982, pp. 1521-1523.

CHAPTER III

SOME TOPICS FOR A COORDINATED POLICY

RESEARCH

Research is the tail that wags the dog. It provides tremendous leverage for new product development, product improvement, higher productivity and better ways of living. It acts synergistically within the scientific community and throughout the economy, with the result that knowledge is doubling every ten years. In recognition of that, the government funds appropriate research under the following criteria:

1. The results of the project are required to support clearly established government responsibility.
2. The benefits of the research are not likely to be appropriable by private firms and such firms are not likely to undertake the project without additional incentive, and direct support is the most effective and efficient means of providing the needed incentive.
3. Its priority is sufficiently high for it to successfully compete for available federal funds.

These criteria are contained in a recent report by the Office of Science and Technology Policy.(1) The report concluded that aeronautic research currently conducted by the government meets all those tests.

Nevertheless, problems abound. The report concluded that aircraft technology is by no means mature, yet government support has declined over the last twenty years (see Appendix A). In recent years, funding not only has decreased, but has fluctuated wildly in the planning stages, making long-term decisions difficult and lowering morale. Individual agency budgets are coordinated at the working level, but are separately considered by agency

heads, the Office of Management and Budget (OMB) and Capitol Hill. Major new initiatives take two to four years to obtain funding and then six months to two years for outside contracting. With decreases in appropriations this contracting has been cut back in order to maintain in-house research groups. These government laboratories represent huge investments (\$6 billion in 1982 dollars), economies of scale, critical mass and non-duplication of effort. But transfer of this technology to industry has suffered.

Recommendations:

1. Stabilize research budgets and coordinate them at least through OMB.
2. Budgets should be set against some national investment goal, weighed against the merits of individual programs and defense needs, and then left alone.
4. Unless budgets are grown significantly, creative ways must be found to involve industry researchers in cooperative projects with government laboratories. It may even involve "good-faith" budget commitments to joint efforts.

These steps would go a long way towards raising research productivity in the aircraft industry. In times of declining budgets and recessions, this is especially important for long-term growth in this sector.

Research policy can be generalized for all industries but it plays a particularly important role in businesses whose products are technologically complex, have a small total market, a high purchase price and low purchasing frequency.(1) Aircraft manufacturing is just such a business and is likely to remain so throughout the rest of the century. The industry may be mature, but the basic technology is still projecting 50% to 100% improvements.

In addition to policy changes, there is a strong need to restructure the management of government research. The issue is not necessarily the diverse number of laboratories and programs; diversity is needed to promote competing approaches to very difficult problems. Rather the issue is the separate management and budget hierarchies of the Defense service branches, the Defense Advanced Research Project Agency (DARPA) and NASA. There is no institutional peer review of research at DARPA or the service laboratories. Between the researcher and Congress, there are approximately 14 layers of management (or nay sayers) in the services, 8 at DARPA and 7 at NASA. For small projects, there is more local autonomy at NASA and the services, but projects with a budget line have at least these many review levels and more.

In addition, the budget cycle requires a lead time of at least 2 years at NASA before money can be spent. At DARPA and the services, the cycle takes 3 to 4 years - if the project is approved in its first submittal. Industry funded research typically takes less than one year and involves 3 or 4 levels for small projects, two years and 6 or 7 levels for larger projects. Clearly industry management is more efficient.

Recommendations for Changes in Government R&D Management

1. Consider consolidating Defense management of research into one entity that has wide latitude under a stable budget level.
2. Require peer review of all major research projects.
3. Micromanagement should be minimized. Formal outside budget reviews of small programs should be made at longer intervals than once per year (e.g., service reviews of laboratory budgets).

4. User involvement in research content should be limited to periodic reviews not management control. This includes in-house and contractor independent research.

This last recommendation would "demilitarize" management of Defense research (6.1, 6.2 and 6.3A budget levels). This has largely taken place in the Navy, Army and DARPA, but not in the Air Force. Military management has proven to be schizophrenic at best due to frequent rotations and inexperience.

TECHNOLOGY INNOVATION

Technology innovation can be loosely defined as the process of developing research results into marketable products. In America we pride ourselves on the entrepreneurial drive that has carried many research ideas in infant industries through to commercial success. However, problems have arisen that cannot be ignored in a world of international competition.

One problem is capital. Venture capital is drawn to small new firms because stock can later be issued at high price-to-equity ratios in anticipation of growth and future earnings. This is not the case for mature industries such as aircraft manufacturing. These companies rely on new stock and bond offerings, commercial paper and bank financing, all of which are based upon considerably lower growth prospects than newer, smaller companies. The problem for the aircraft industry becomes one of maintaining technology innovation in the face of reluctant capital markets.

In Japan and France this situation is apparently eased somewhat by various mechanisms. Banks in France are nationalized in order to serve broader goals in addition to narrowly defined returns on investment. Banks can own equity

positions in companies that can be used to focus management decisions on production growth rather than on mergers and paper manipulations that do not increase output. Banks in Japan are restricted from exporting capital which keeps interest rates down. These lower interest rates reduce innovation risk since they lower the magnitude of payoff required and extend the development time needed to turn a profit.

In recognition of the long development times and high risks in the aircraft industry, many foreign governments are willing to arrange low or no cost development loans. In some cases, repayment is forgiven if sales do not materialize. The goal appears to be to stabilize employment, maintain or increase market share and prevent "brain drain."

Furthermore, during development of military aircraft such as helicopters, specifications are written to include civil market needs as well, thus broadening the production base. The French Super Puma helicopter is a recent example. This has created a much less adversarial relationship between government and industry. This is especially important in the civil certification process where an adversarial approach can serve to discourage technical innovation when the aircraft is in the design stage.

In addition to the areas of capital targeting, specifications, and certification, surprise changes in regulations and market conditions are also a factor in innovation risk. Some of those surprises are outside of the government's control such as a huge jump in fuel costs. However, in this country, government is intimately involved in such activities as: the rapid deregulation of the airlines; threatening safe harbor leasing and Domestic International Sales Corporations which provide tax relief;  or traffic

controller strikes; noise and pollution regulation; airport and heliport siting; landing slot allocation, curfews and landing fees; and assistance with sales to foreign governments. This government involvement creates a different sort of market challenge than that faced by such industries as electronics or machine tools.

In this atmosphere the aircraft industry must deal with planning horizons for innovation from 6 to 12 years. This requires some constancy in market assumptions in order to proceed. Any muting of rapid changes caused by government policies would be welcome.

Recommendations

1. Changes in government regulations that affect the aircraft marketplace should be phased in over long periods to lower risks to manufacturers.
2. Certification should be reasonably non-adversarial with the FAA working with the companies at a very early stage to lower the risk of rejection of new innovations.
3. Government research should be extended in those areas that lower the risk for critical certification of technical innovations.
4. Company independent research and development allowed under military contract overheads should be increased at least to those levels charged against commercial sales.
5. The Department of Defense should consider compromising military specifications where sales of civil versions of that product could lower production costs or repay some development costs through royalties.

6. A variation of #5: the government should fund development of dual use aircraft where military requirements dictate only wartime use or special use in peacetime. Development of the heavy lift helicopter is an example: military use would be infrequent and costly, whereas leased for civil work, the aircraft would generate productive revenues; civil development alone, however, is thought to be too risky.
7. Create an industrial development trust whose loans are subsidized by government to promote technology innovation. Plants (not companies or conglomerates) would have to satisfy the following general criteria (see Basic Assumptions):
 - a. sales have the potential to clearly account for a positive net export balance.
 - b. production factors are not resource or low wage intensive.
 - c. products are knowledge intensive and high valued added.
 - d. wages are tied to productivity and international competitiveness.
8. Tax relief is not recommended since it depends solely upon the profit status of a company. Aircraft companies are generally low profit operations whose market share and technological advantage may be of equal importance to return on investment.

The intent to these recommendations is to ensure that aircraft not go the way of other technology sectors where Americans and Japanese invest, but Japanese are first to produce. The key is for government to provide the "grease" needed for technology innovation. Such innovations can help assure international competitiveness and higher capital and labor productivity.

TRADE

No other area requires as much immediate attention for coordinated policy as trade. Since World War II, broad liberalization of trade barriers has led to the internationalization of domestic markets. It is estimated that in 1982 imports of all manufactured goods amounted to 19% of final goods sold in the United States. For exports the number was 17%. In addition, 70% of all manufacturing jobs are at risk to potential import substitutes. One out of every five jobs depends upon exports, 3 out of every five in the aircraft industry. Goods and services, and even capital flow relatively freely across American borders, yet very few trade practices are governed by multilateral agreements.

The General Agreement on Tariffs and Trade (GATT) and the associated Civil Aircraft Agreement (CAA) regulate tariffs, some trade practices and, recently, baseline financing. However, these agreements do not cover quotas, offline "private" financing, special barter agreements and government embargo control, deliberate delays and red tape, and unwarranted specifications. Enforcement is slow, rendering it largely ineffective for the aircraft industry. This is due to the fact that initial sales lock a customer into a product line and its support for years. Initial sales may only be 10% of the total value of the business. Thus obtaining an enforcement ruling after the first sale has been made is too late.

In the case of the CAA, Brazil, Indonesia and Israel are not signatory nations. In Brazil, sales of small turboprop aircraft with below market interest rates and little or no money down have virtually built the commuter airline network in this country. U.S. government retaliation, such as anti-dumping rulings or countervailing duties, were not used despite protests by American companies.

All governments promote trade to varying degrees. In the aircraft sector, in addition to the previously mentioned practices, there are price subsidies, pressured purchasers by national airlines, awards of routes and landing rights, and biased reservation networks (to name a few) that influence trade deals. The Law of Comparative Advantage appears to have been expanded to include the actions of governments in the name of social goals, prestige and local politics. The United States is not blameless in this arena. Non-specific programs for export promotion include financing, insurance, tax relief and trade fair sponsorship. However, in the United States unlike other countries there is no overall coordination and no single government agency in the driver's seat. Today, fewer than 10 officials (out of some 3000 involved in trade in 4 agencies) represent aircraft trade interests.

Recommendations

1. President Reagan has called for a reorganization of trade activities. We endorse this as long as there is an increase in manpower assigned to the aircraft sector commensurate with its needs and importance.
2. The newly created Defense Policy Advisory Committee on Trade should be made permanent although it apparently only covers a small portion of trade matters, primarily those related to defense.
3. A proactive policy on negotiation is recommended to lead toward freer trade.
4. Retaliatory measures for anticompetitive trade practices should promote American production through appropriate subsidies rather than restrict trade.

In the aircraft market this last recommendation would not unnecessarily lower world prices since deals are few and infrequent. The issues are complex which is an added reason for recommending coordinated, government-wide policymaking. American aircraft products are fully competitive and compare favorably to any fairly marketed foreign aircraft if given the chance.

PROCUREMENT

The procurement process has been used in various ways to carry out government policy. Social policies have required equal opportunity programs and other employment practices. Political policies are evident in provisions for small businesses and domestic purchases. Defense policies promote critical suppliers and commodities such as jeweled bearings. Yet only recently has the procurement process been used to promote industrial policies that effect productivity. Even these actions have not always been positive for the industry as a whole: direct, selective grants to one company for automation can freeze out competition that may be desirable.

In the aircraft sector the Department of Defense is such a large customer that its contract practices have a powerful impact. But because its procurements are individually transacted, the Department can lose sight of what is best for the industry and the nation as a whole, particularly for the long term.

Jacques S. Gansler has suggested that the government use astute planning and specific contract practices to "rationalize" the aircraft marketplace.¹ The industry might then be encouraged to evolve more naturally into a few large and highly efficient companies. Such a structure could maintain

domestic competition and a diversity of approaches. In addition, this consolidation could enable more aggressive competition in the civil international marketplace. As discussed in Appendix A, such civil sales are a source of defense mobilization.

Another important idea is that the nature of the aircraft business is changing. Capital and technology are replacing craft labor. Indirect, highly skilled labor is increasing. Such investments cannot be easily "laid off" with production swings. They must have a large and stable base to amortize costs. As such, capital productivity is as important as labor productivity in lowering defense costs and assisting international competitiveness.

Stability would also help lower labor costs. During slack times a "critical mass" of employees must be carried on overhead. During boom times, premium wages must be paid to attract new recruits and lure former employees back. Retraining is necessary. By some estimates, this results in labor costs that are 30% above industry norms (see Appendix A).

An additional problem is the proliferation of procurement regulations and documentation requirements. A Boeing Company study claimed that government purchases cost 30% to 40% more for the same product purchased by a commercial customer. The "never again" syndrome has imposed an adversarial atmosphere on government-industry relations, encouraging more controls, lengthening schedules and contributing to unintended "buy-ins." Such "buy-ins" or initial low bids can result from not allowing the contractor enough flexibility to meet the intent rather than the letter of the contract. The natural advantages of competition may offer a solution to many of these problems but sole-source contracts seem to be the norm (see Appendix F).

Recommendations

1. Stability of a company's labor force and its supplier base should be achieved through stability of production. Military procurement should be varied, where possible and appropriate, to compliment fluctuations in civil markets. This is not impossible since lead times for civil orders and defense production authorizations are similar: 2 to 4 years.
2. Investment in productivity improvements should be encouraged by:
 - multiyear procurements.
 - early recoupment of costs.
 - sharing returns from cost savings, particularly on the next order lot.
 - allowing cancellation costs for long lead orders made for productivity improvements during the proposal process.
3. Adversarial audit burdens should be trimmed through creative contracting:
 - bidders could be allowed to forego award appeals in exchange for reduced proposal documentation.
 - progress payments could be dropped on selected programs in exchange for allowable interest costs, deposit fees and cancellation penalties at time of delivery, similar to commercial practice.
 - full commercial rates should be charged on government owned plant and equipment to encourage company ownership, eliminating tracking procedures for their dual use on military and commercial programs.

4. Competition should be encouraged at all levels through:

- dual sourcing or leader/follower arrangements.
- separable joint ventures such as the Bell-Boeing JVX contract where future competition can be required by splitting the partners.
- competing production as well as development.
- frequent competition in exchange for using only broad measures such as performance, cost and schedule in place of detailed accounting.

Most of these recommendations affect only the Department of Defense. As such, they may be easier to implement than other broader policy changes. The result should be lower costs to the government and a healthier industry competing for commercial sales. The so-called "Carlucci" initiatives in 1981 were a good start and are readily endorsed.

LEGAL CHANGES

The basic reason that the U.S. has antitrust laws is to maintain competition. The natural outcome of unrestricted competition in the business world is a monopoly. The undesirable effect of a monopoly is a seller's market in which the consumer, stripped of bargaining power, is ripe for exploitation. U.S. law has recognized this danger and has regulated trade in three areas: it forbids contracts in restraint of trade, combination or conspiracies in restraint of trade, and unfair competition.² These goals are the foundation of the Sherman Act of 1890, the basic U.S. antitrust policy. Through the years, additional antitrust legislation was believed necessary to regulate business practices. The Clayton Act of 1914, as amended

by the Robinson-Patman Act of 1936, the Celler-Kefauver Antimerger Act of 1950 and the Federal Trade Commission Act of 1914 were all designed to regulate business practices leading to concentration and monopoly.

The world has changed since the basic federal antitrust statutes were enacted with the Sherman Act in 1890. International trade is now a vital portion of the U.S. economy as well as the economy of many other nations in the world. Businessmen now think in terms of the global market place. Nations such as Japan, France and West Germany have developed international business strategies. In order to amass the large capital required for international business, Japan has encouraged joint ventures among her industrial giants. The world is evolving towards a grouping of corporate business nations who compete with other corporate business nations.

The U.S. antitrust laws described above have prevented U.S. corporations from joining together to embark on international joint ventures. In order to remain contenders in the international market which requires large amounts of capital and large scale operations, U.S. companies have been turning to joint ventures with foreign partners. The agreement between General Motors and Toyota is a recent example in the automotive field. Examples in the aircraft industry include General Electric and Snecma (French) producing the CFM56 engine and Fairchild and SAAB producing the SF340 commuter aircraft. Well known examples of foreign cooperation are the Concorde and Airbus. Lesser known are ventures such as the ATR42 commuter aircraft which is a joint effort between Aerospatiale and Aeritalia, funded by the French and Italian governments.

Since taking office, the Reagan Administration has indicated that

antitrust constraints will be loosened for companies engaged in international joint ventures where the capital investment required is larger than what any single company may be worth. No U.S. company, however, is ready to become a pathfinder and risk antitrust litigation based on presidential statements and changing legal interpretations.

Recommendation

If the U.S. is to remain a contender in the world marketplace, serious thought must be given to revising the current antitrust laws to allow large U.S. companies to join to meet world competition. If there were no tariffs and no restrictions to international trade, then the test for competition could be worldwide, not national. The concept of a world with completely free trade and international competition is ideal and probably unrealistic. However, the concept of two large U.S. corporations joining in a joint venture for worldwide business is realistic and should be encouraged.

The advantages of two U.S. companies joining for business would be a reduction in the technology transfer that occurs when a U.S. company teams with a foreign partner. (This is particularly true for management and manufacturing technology.) Additionally, it is presumed that a larger portion of the design, production and profits would remain in the U.S.

The need is clear and the solution seems apparent. The U.S. antitrust laws should be revised to allow two or more companies to join for the purpose of international trade provided foreign competition has access to the U.S. market giving the buyer a choice.

EMPLOYMENT

Employment policies in the U.S. government fall into two categories: legal structures and financial subsidies. The legal policies cover labor union laws, laws incentivizing corporate behavior towards their employees and laws requiring certain practices toward their employees. Financial subsidies include direct grants for training, education, relocation, unemployment, retraining and hiring. Indirect financial subsidies include tax concessions for all of the above plus allowances in government contracts for on-the-job training and "bridge" contracts to keep critical worker skills employed between major procurements.

Labor union laws are perhaps characterized more by their negative impact than anything else. Laws governing such matters as collective bargaining, right-to-work, union shop, and strikes tend to lock into place adversarial relationships between management and worker. There are no laws governing working representation on Boards of Directors or even quality circles, and no requirements for advance notice of plant closings. Labor has been forced to concentrate on matters of pay, work conditions, seniority and fringe benefits. They have little voice in job design, enlargement or enrichment unless management decides it is in its best interest to do so.

Laws incentivizing management behavior are no better. Deferral of overseas taxes and foreign tax credits allows companies to export jobs to low wage countries more readily. Tax credits for equipment purchases, where not balanced by tax credits for hiring, skew the balance between labor and capital in decisions made by management.

Laws regulating business employee practices such as affirmative action are in better shape in this country than most. Regulations governing worker safety, non-discrimination and fair labor practices do shift the balance away from labor to capital but the costs to employment appear justified. Certainly the use of robots in high risk, repetitive tasks was welcomed by management and labor alike.

Direct financial subsidies are usually easy to account for. The federal government provides enormous educational grants to universities and aid to public schools. NASA, NSP, the Department of Energy and Defense all target educational grants and scholarships. The G.I. Bill and the National Defense Education Act loans are direct subsidies. Of course, unemployment benefits and hiring incentives such as CETA fall in the category also.

The Trade Act of 1974 provides direct subsidies to those workers who lose their jobs due to imports (but not apparently loss of export sales). The act provides training, job search and relocation allowances, as well as up to 70% of previous weekly earnings for as much as a year. The Department of Labor makes such determinations. Unfortunately, with the generous unemployment benefits, but only \$1,000 allowed for search and relocation, this Act tends to keep workers in place. Furthermore, it only affects primary companies not suppliers or subcontractors.³

Indirect subsidies such as tax relief (or more properly called tax expenditures) cover such areas as education and moving expenses but only under some narrow definitions. Management has some tax incentives to hire workers under the WIN program and is allowed to expense training costs fully. Other indirect subsidies occur when government procurement pays higher negotiated overheads in its contracts for training, research and other indirect employment.

Recommendations

The issues are complex and changes in government policy are not at all clear. Many changes are already occurring in the private sector with little encouragement from government. New management perspectives have lessened the adversarial process with labor through quality of work life programs and quality circles. Procurement stability is leading to employment stability. Companies are lending out key people during slack periods. White collar pensions are now vested, but could be made more portable if a separate, central fund were created along the lines of union pension funds.

The toughest problem facing the aircraft industry may be automation. The full effects of automation on the labor/capital mix in manufacturing may go beyond the borders of an individual company. Capital depreciation and investment tax credits can skew a company's capital/labor mix. Yet unemployment, retraining and the importing of automated equipment may raise the cost to society. This subject is not well understood and deserves further investigation.

COPRODUCTION

One of the unique elements in the aircraft industry is the significant amount of production that "leaves the parent company." This includes parts production, licensed production, and coproduction. Now a trend towards joint ventures seems to be evident in large, costly programs. Reasons for these production arrangements vary from traditional business considerations such as cost, schedule, and the enormity of the task performance to marketing tactics such as acquiring knowledge of buyer needs and leverage for future sales.

In many instances foreign governments have intervened in order to secure these arrangements. Examples include the F-104 and the F-16 and numerous helicopter programs. In those helicopter programs, licensing and coproduction have gone beyond traditional military procurements into civil marketing. Foreign governments offer development financing and favorable purchases in order to obtain domestic production.

The reasons for the government activity vary from country to country but most always include domestic employment, balance of trade, prestige and independence. In almost every case, however, the actual direct cost of the domestically produced product is higher than if it was simply purchased abroad. The F-16 produced in Europe costs about 25% more than one produced by General Dynamics. The purchase premium for the total Japanese buy of F-15's is estimated to be \$1.6 billion over that which was offered by McDonnell-Douglas.

Economically, when such coproduction inefficiency is present, everyone is poorer because of it. If the deal was strictly commercial and would have occurred anyway, the imposition of coproduction is an enormous distortion of the marketplace and free trade. It also creates future competition for American firms. If the deal was for military purposes, then in terms of getting the most defense for the money against the Soviet Union, the whole Free World may suffer.

Recommendations

1. Commercial coproduction, if imposed by foreign governments for other than traditional business reasons, should be prohibited by GATT.
2. International joint ventures induced by foreign governments should be examined by our government to determine if they are in the national economic interest, and whether or not an all-American solution is possible with or without federal assistance.
3. Military sales should be balanced by offsets of other products, or barter if that is necessary to avoid coproduction.

This last recommendation may mean the purchase of Belgium rifles, British steel, German tanks and Italian maintenance agreements, but it would be a more efficient expenditure of defense dollars. (In the case of Japan it would mean new imports to the U.S. but not a change in the sanctions on Japanese military exports to third world countries.) The economic benefits are multiple. Each country would achieve economies of scale, not only in production but in research and innovation as well.

FOOTNOTES
CHAPTER III (Pages 13-32)

¹ Jacques S. Gansler, "The U.S. Aircraft Industry: A Case for Sectoral Planning." Challenge magazine, July/August 1977, p. 17.

² Edwin Timbers, "A Summary of Antitrust Principles," Unpublished paper, Industrial College of the Armed Forces, Washington, D.C., 1982, p. 3.

³ Ira C. Magaziner and Robert B. Reich, Minding America's Business, (Harcourt Brace Jovanovich, 1982), p. 211.

CHAPTER IV

CONCLUSIONS

What does it mean to say that knowledge is doubling every ten years? On the research level it means that ideas are expanding geometrically but that there is no longer enough money to address all the possibilities. On the warfare level it means that adversaries must be quick to respond to the other's latest invention and that the possibility of technical surprise has increased. On an economic level it means that many countries--if they choose to do so--can outspend the United States in a given technical area. We simply cannot cover all the bases.

For those industries whose technology is vital for national defense, we cannot afford inefficiencies born of contrary policies or congenital neglect. We must make the best decisions, have the best research, and develop and sell the most productive products to maintain our standard of living and national security. To do less in a world of free trade is to abdicate our leadership in products whose comparative advantage relies on a continuing technological lead. Furthermore we must export those products to help pay for the research needed to maintain that lead.

In the aircraft industry we believe that the challenges to our international markets must be met with a coordinated long term effort. We cannot hope to duplicate the industrial policymaking of our competitors because our cultural heritage is different. But we can marshal our resources in uniquely American ways. Economically we are no longer the dominant world power,

especially in manufacturing. We must think like a small country in order to survive. This means more cooperation and fewer adversarial processes, more pulling together for a larger cause, and fewer "beggar-thy-neighbor" policies.

This paper outlines a process and a structure that seeks to meet those ends. It recommends the creation of a government unit since one of the things government does well is act as a focal point for concerted action. This unit should be small but should bring together labor and management, and the executive and legislative branches to coordinate policy. The academic and financial communities should be represented also as well as members of the technical media. Only by assembling in one place all of the key policymakers, and the forces that shape political opinions, can there be a chance of successfully coordinating industrial policies.

The structure we recommend should not be bureaucratic, but modeled after the best organizational aspects found in Japan and other countries with successful industrial policies. For an American solution, the proposed new unit would not require or dictate actions to its invited participants. It would indicate policy direction through a consensus-building process, but allow individual freedom of action. We believe that it should stand firmly for competition and competitiveness, free trade and fair trade. It can recommend broad policy for others to implement, but more importantly it can point out the implications of such broad policy on one key industrial sector, the aircraft industry.

The historical success of the American aircraft industry is no accident. The recent success of foreign competitors like Airbus is also no accident.

In all cases government policy was instrumental in that success. Like France and Japan, the United States has a broad range of policy tools but lacks the coordination needed in a world grown smaller by international trade and fierce competition. We hope this paper makes a useful contribution to those who are struggling for ways to respond to these challenges in order to insure both a secure and prosperous future.

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* This includes formal activities organized by the Industrial College of the Armed Forces.

APPENDICES

- APPENDIX A: Background
- APPENDIX B: U.S. Policy and the Aircraft Industry
- APPENDIX C: French Policy and the Aircraft Industry
- APPENDIX D: Japanese Policy and the Aircraft Industry
- APPENDIX E: The Airbus: A Case Study
- APPENDIX F: Two Staff Studies: Multi-source
Procurement and Government Aircraft
Depots

Background

The aircraft industry plays a significant role in the economy and national security of the country. However, there are indications that the industry is losing its world leadership role in the design and manufacture of commercial aircraft. (This market is not static and is expected to show substantial long-term growth beyond the usual replacement needs). This loss of leadership will reduce the United States industrial base for war mobilization and it may substantially raise the cost of military aircraft purchased in peacetime. Loss of manufacturing leadership will lead to loss of technical leadership which is potentially damaging to the effectiveness of our future military aircraft.

On a broader scale, this loss is reflected adversely in the balance of trade, employment, standard of living and a curtailment of one of the major sources of technological innovation. Indeed, the time is near when high quality commercial aircraft will be no longer synonymous with American prestige and know-how. This appendix will examine each of these statements in turn to present a case for a change in U.S. government policy.

1. The aircraft industry plays a significant role in the economy and national security of the country.

Aerospace manufacturing involves over 4,000 companies in all 50 states in the production of airframes, engines, parts, avionics and missiles. In 1981 aerospace sales constituted 2.1% of the Gross National Product and 6.2% of all sales from durable goods industries.(1) Its employment of 1.6 million in primary and related industries is second only to the manufacture of automobiles.(2) The breakdown of this business is shown in Figure A-1.

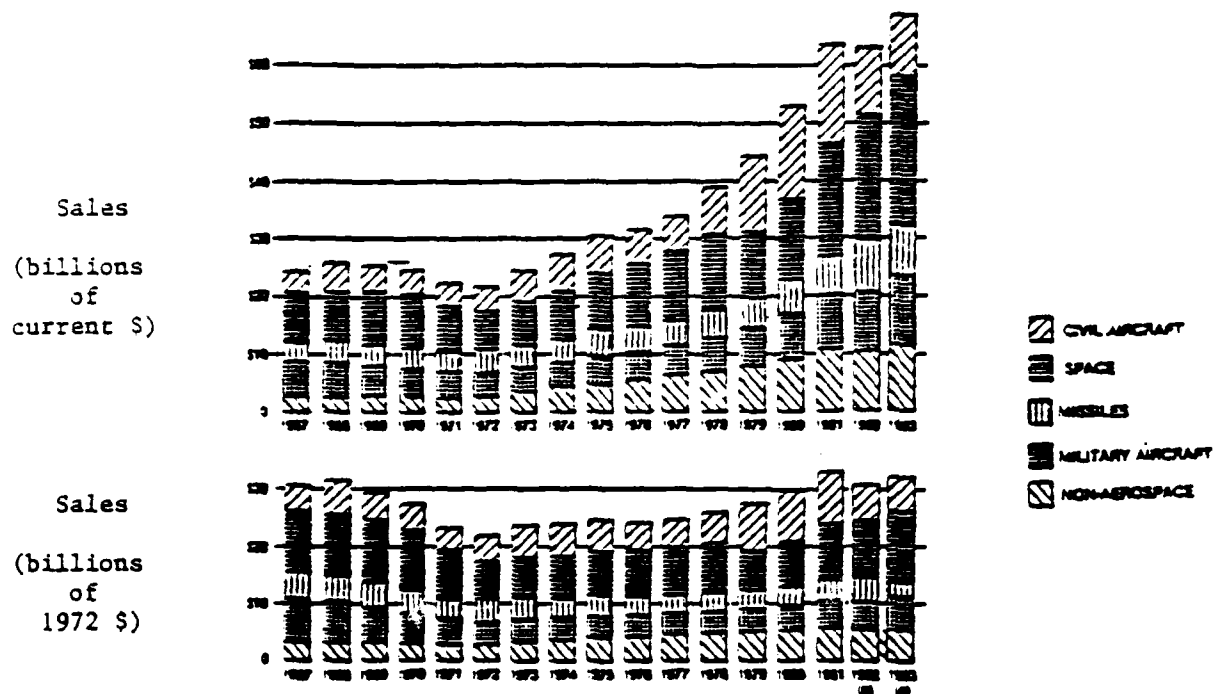


Fig A-1. Aerospace Sales.

The value of aircraft business alone was \$40B in 1982. Slightly over 50% or \$1B was military, a reversal of recent trends. This military share of the market is projected to increase markedly.

As a percentage of the Defense budget, aircraft constitute 30% of the total procurement budget.(3) Aviation related costs, including personnel, maintenance and procurement, represent about 1/3 of the overall Defense budget. Furthermore, Defense strategy in any military conflict is predicated on the superior performance of these aircraft and their weapons.

2. The U.S. aircraft industry is losing its leadership role in the design and manufacture of commercial aircraft.

For most large aircraft, a production run of 300 to 400 airframes is required to break even financially.(4) With each model change (stretch, engine, wing, etc.) to meet customer preferences, the breakeven point increases (Figure A-2).

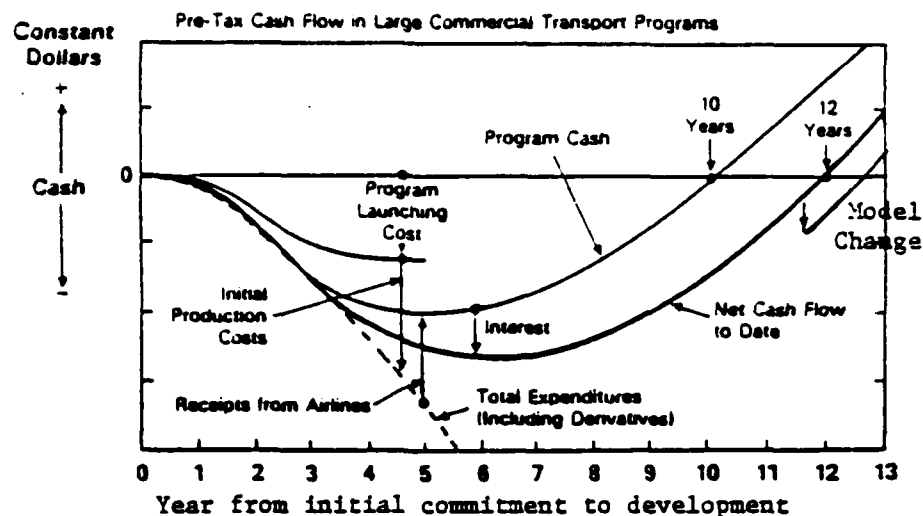


Fig A-2. Investment Cash Flow.

Coupled with this idea is the fact that over half of the market is overseas and increasing rapidly. In 1970, 46% of all passenger miles were on non-U.S. airlines. In 1981, that figure was 57%.⁽⁵⁾ Therefore, U.S. companies must consider the international market in the very first stages of an aircraft design. Competitive access to these markets is vital if a company is to secure the \$2-\$3 billion that it takes to launch a new civil transport aircraft. Banks must have a reasonable assurance that the new production will have access to buyers outside the U.S.

How well is the U.S. doing in the international market? Recent data is quite mixed, but the long-term trends are disturbing. In the sale of large commercial airliners, U.S. products have lost significant market shares to the European Airbus. (Figure A-3)

In 1982 the world recession hit Airbus as well as Boeing and Douglas. Orders for the Airbus A300 declined in 1982, reflecting a cancelling of orders - but not necessarily a switch to a U.S. product. With the exception of

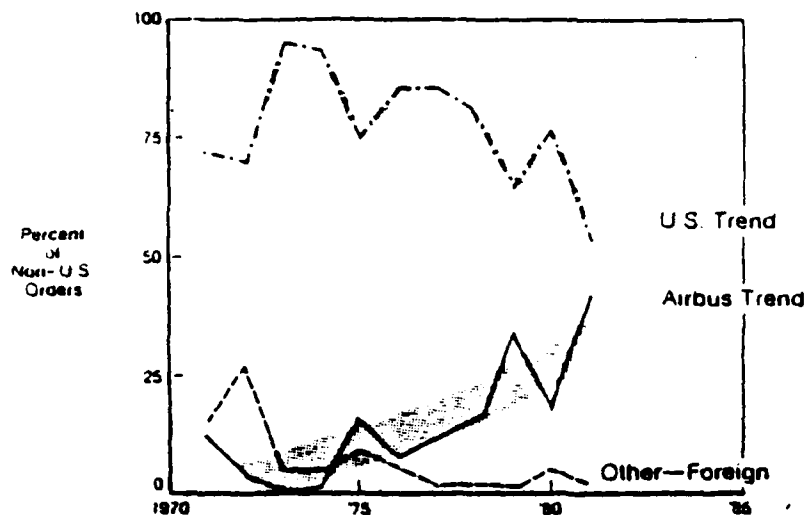


Fig A-3. Non-U.S. Sales of Wide Bodied Aircraft.(6)

Eastern Airlines, the A300 has yet to penetrate the U.S. marketplace. Nevertheless, the long term trend is not comforting. The European governments seem willing to stand behind their participation in Airbus Industries and finance follow-on models (A310 approved, A320 pending). This subject will be covered more fully in Appendix E.

In the helicopter market, a worrisome situation is already at hand. Through careful targetting of research support, the French government has assisted Aerospatiale in producing helicopters that are as technically advanced as any U.S. machine. The company and the Ministry of Defense have carefully orchestrated military and civil market specifications to achieve common designs that now enjoy broad acceptance around the world. Figure A-4 shows the growth of the market shares by European manufacturers, particularly Aerospatiale. Indeed, half of the jobs in helicopter engineering and production are now located outside the U.S.

In the category of general aviation aircraft, the situation is even grimmer. These aircraft cover the fields of commuter, business and sport

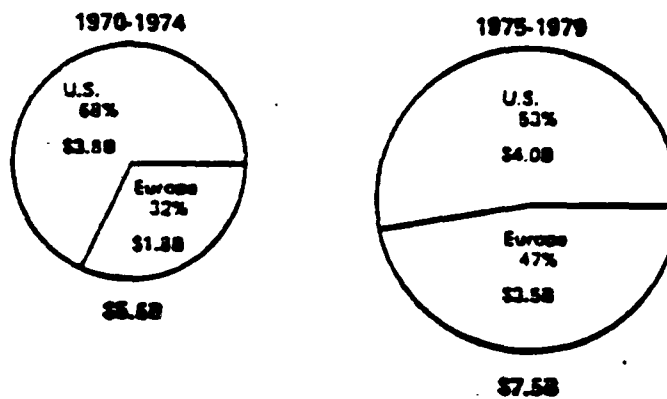


Fig A-4. Helicopter Market Shares.(7)

aviation. Since reliable sales figures are not available for non-U.S. companies, the best measure of market trends is the balance of trade. (Figure A-5).

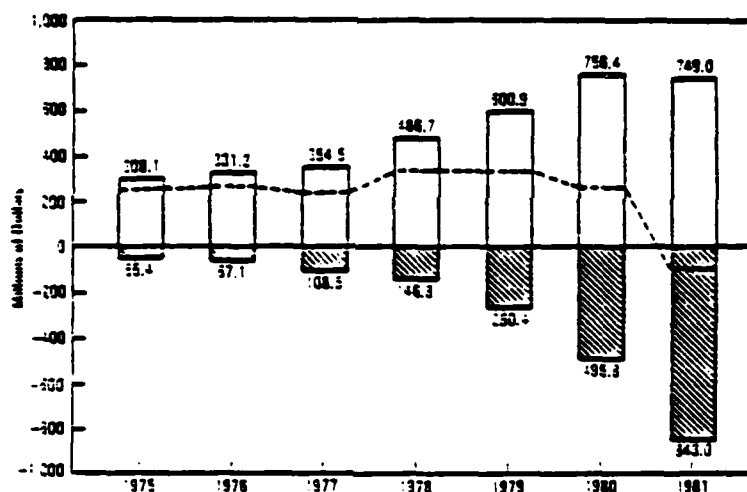


Fig A-5 General Aviation Balance of Trade.(8)

The reasons for this disturbing trend are many. Certainly the world recession and the overvaluation of the U.S. dollar are significant contributors. But this has been exacerbated by the policies of this country and those of France, Great Britain, Japan, Brazil, Israel and Canada. For our own part, we have interrupted and banned sales for economic reasons (sanctions), for reasons of state (human rights) and national security

(technology transfer). The result is that the U.S. is viewed as an uncertain supplier. Consequently, other countries have fostered an indigenous industry producing general aviation airplanes as a first step in insuring their national security and economic independence. Such fostering follows the practices in their airliner and helicopter industries: grants for research, development, production subsidy, and capital improvement; low or no interest development loans; cartel formations; trade promotion at all government levels; tax incentives and relief; and below market sales terms. The result is a plethora of models. Figure A-6 graphically shows this for commuter aviation.

3. The market for aircraft is not static, but is projected to double in the next ten years. (Figure A-7)

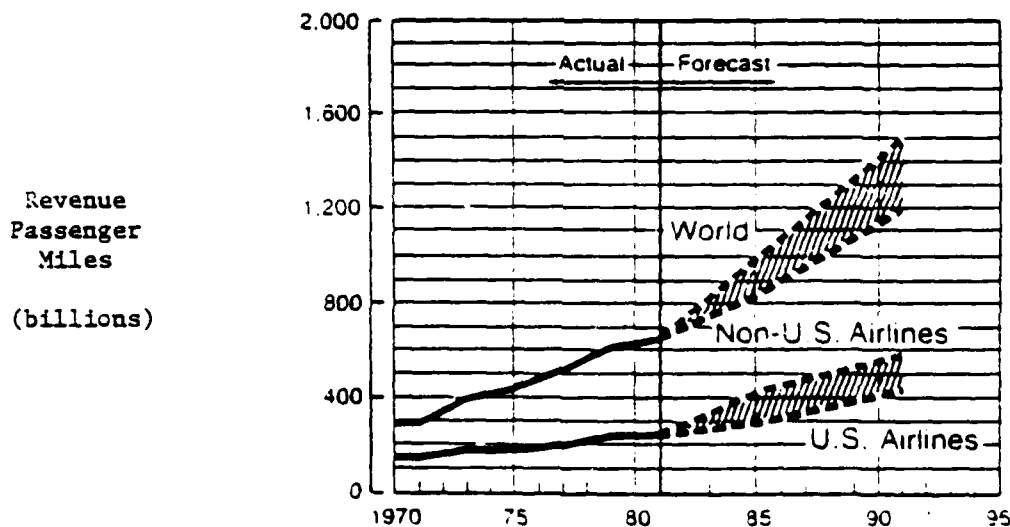
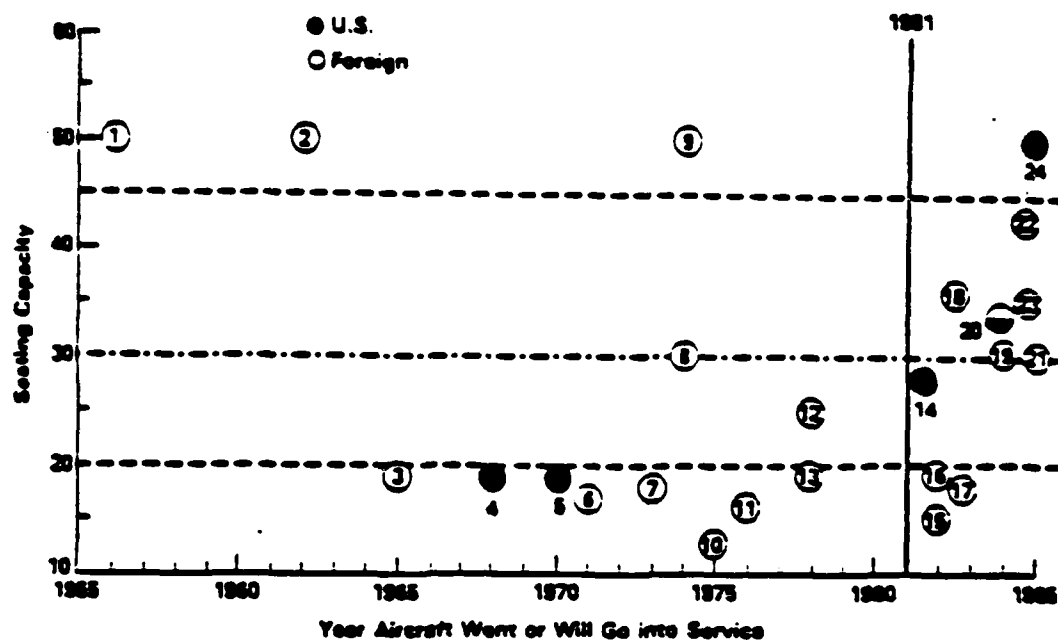


Fig A-7. Civil Aircraft Market Projections.(10)

The proliferation of commuter airlines and helicopters is no accident. Deregulation of the airline industry, new technology, noise and pollution standards, and the growth of the business market for small transports has



- | | |
|------------------------------|------------------------------|
| 1. Fokker F-27 (Netherlands) | 13. Arava 101B (Israel) |
| 2. BAe 748 (UK) | 14. AR 404 (US) |
| 3. DHC-6 (Canada) | 15. Do 228-100 (W. Germany) |
| 4. Beech 99 (US) | 16. Do 228-200 (W. Germany) |
| 5. Metro (US) | 17. BAe Jetstream 31 (UK) |
| 6. BN Trislander (UK) | 18. SD 360 (UK) |
| 7. EMB 110 (Brazil) | 19. DHC-8 (Canada) |
| 8. SD 330 (UK) | 20. SF-340 (Sweden/US) |
| 9. DHC-7 (Canada) | 21. EMB 120 (Brazil) |
| 10. Nomad 22B (Australia) | 22. ATR 42 (France/Italy) |
| 11. Nomad 24A (Australia) | 23. CN 235 (Spain/Indonesia) |
| 12. CASA 212-200 (Spain) | 24. CAC 100 (US) |

Fig A-6 First Date Introduction of Commuter Aircraft.(9)

fueled a burgeoning demand for helicopters and 10 to 50 seat transports. For large transports the growth will come from the emerging prosperity in the third world coupled with lower costs per seat mile due to new technologies. Recovery from the world-wide recession, lower fuel costs and attractive new aircraft will supplement this growth for the rest of the world. Reequipment cycles will also insure a stable underpinning to future demand.

4. The loss of leadership in the manufacture of commercial aircraft reduces the U.S. base for industrial mobilization.

Industrial capacity for mobilization is usually defined at three separate levels.(11) They are:

- a. Nominal capacity - maximum tonnage output in one 40 hour shift in a company's peak year.
- b. Peak capacity - same as nominal but in 1.4 shifts.
- c. Mobilization capacity - 3 full shifts and a 48 hour week.

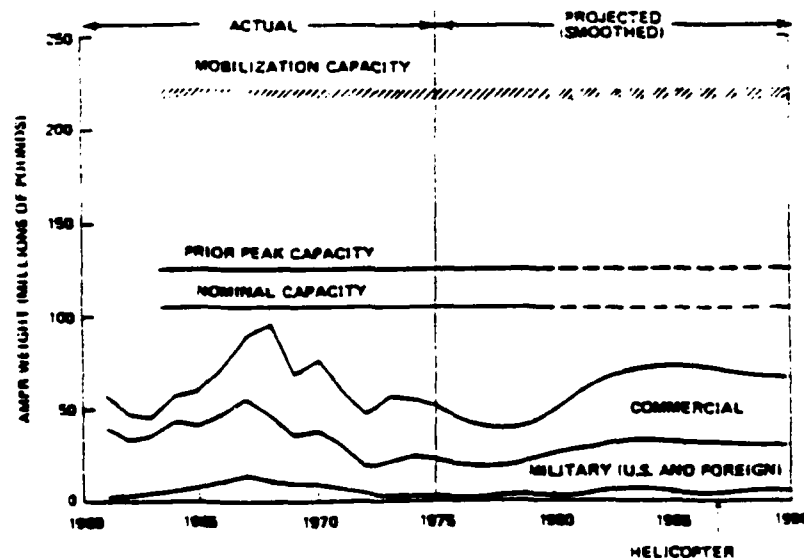


Fig A-8. Production Capacity.(12)

For the aircraft industry this is depicted in Figure A-8.

Most companies experienced their capacity years in 1967-69. These data are only for 17 major aerospace firms, not including subcontractors, but including spare parts and equipment.

In practical terms, the mobilization and peak capacities are closer to the nominal value due to bottlenecks in the commodity supplier firms. Some of these bottlenecks can be overcome with better DOD procurement practices. However, these bottlenecks can be examined in a different light. For the most part, they assume that both war production and civil production take place simultaneously. If war priorities were invoked, these bottlenecks would largely disappear simply due to the fact that commercial sales for these industries would be deferred. Such commercial sales constitute over half the business of many of these firms, providing a strong base for mobilization.

This assertion remains valid even for companies that are closely identified with military procurement. Northrup, LTV, Fairchild and Rockwell would not exist in their present form without subcontracts for major parts of commercial airlines. Here, the key parameters that were usefully employed were not plant space, but machine tools and skilled personnel. A numerically controlled machine can just as easily turn out landing gear for the 757 as the F-14; engineers and skilled labor are equally adept at military aircraft and civil transports in most cases. The major differences occur in the design team expertise and in analytical tools for such things as peculiar aerodynamics, survivability, and shipboard interface. However, these areas of difference constitute a small percentage of the overall effort.

5. Loss of commercial aviation leadership may raise the cost of military aircraft purchased in peacetime.

Commercial sales have an enormous spillover to the military market. Those above mentioned subcontracts from prime commercial airline manufacturers kept overhead expenses lower for military business during slack periods in military production. Bell Helicopter and Hughes Helicopters would not have been able to mount timely, competitive bids on military business without a strong commercial base. Engineers and design teams are kept active. Keen competition in commercial sales have spurred productivity improvements that carry over to military production.(13) In addition, solutions to development problems in civil versions of military aircraft have benefited those Defense products in subsequent improvements.

6. Loss of manufacturing leadership will lead to loss of technical leadership which could damage the effectiveness of future military aircraft.

Without commercial sales, aircraft companies as a whole would be forced to cut their research and development efforts in half. Figure A-9 shows the present mix of sponsorship between civil and military R&D.

The U.S. military strategy relies heavily on the technical superiority of its aircraft. Without commercial sales, progress in engine design would be significantly retarded. Large composite structures would not be attempted. Highly reliable avionics would still be on the drawing board. The test of these assertions lies in the helicopter industry: with a very small commercial base, most of the technical developments were force-fed through government research and procurements.

R & D
(billions
of 1979
dollars)

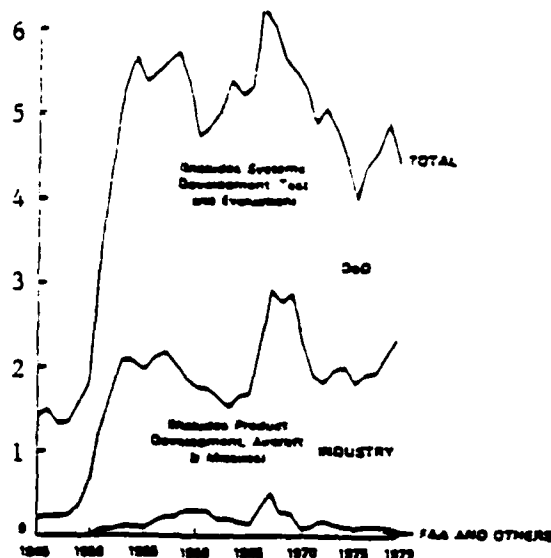


Fig A-9. History of R&D Expenditures.(14)

7. Loss of leadership in commercial aircraft is reflected adversely in the balance of trade.

Aerospace exports constitute the largest net export account in manufacturing. Five out of the top 10 export companies are in the aircraft industry. However, there is reason to believe that this will change. With surging imports and an overvalued dollar, the net balance declined in 1982 and

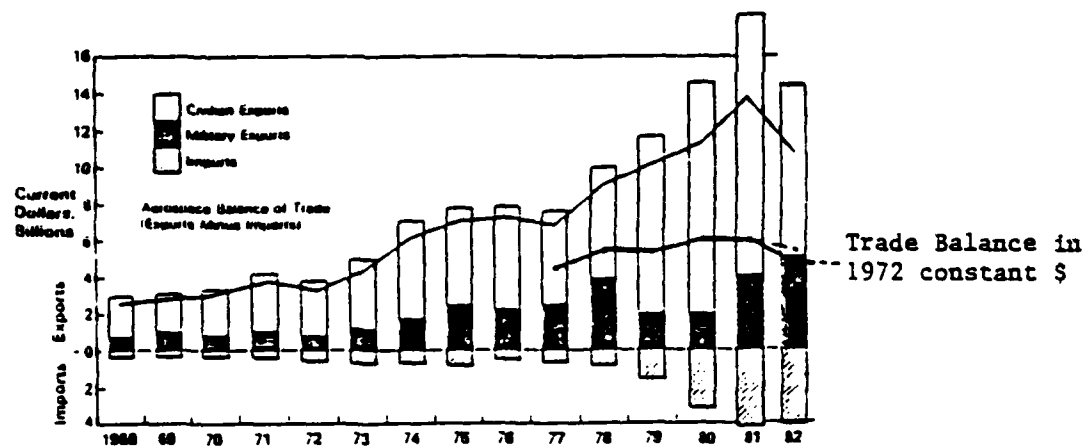


Fig A-10. Aerospace Trade Balance.(15)

may decline even further (Figure A-10).

The contribution of commercial jet aircraft to this picture is depicted in Figure A-11.

This decline is due to both the world recession and the loss of wide-body airliner orders to Airbus. Despite the overvalued dollar, Boeing can still compete with Airbus. The change in the value of the dollar from 1979 to 1981 has been simply a windfall for Airbus (or reduced subsidy) since all jet aircraft sales are priced in dollars.

Added to this picture is the poor trade picture in general aviation (shown earlier) and in helicopters, where imports have been doubling since

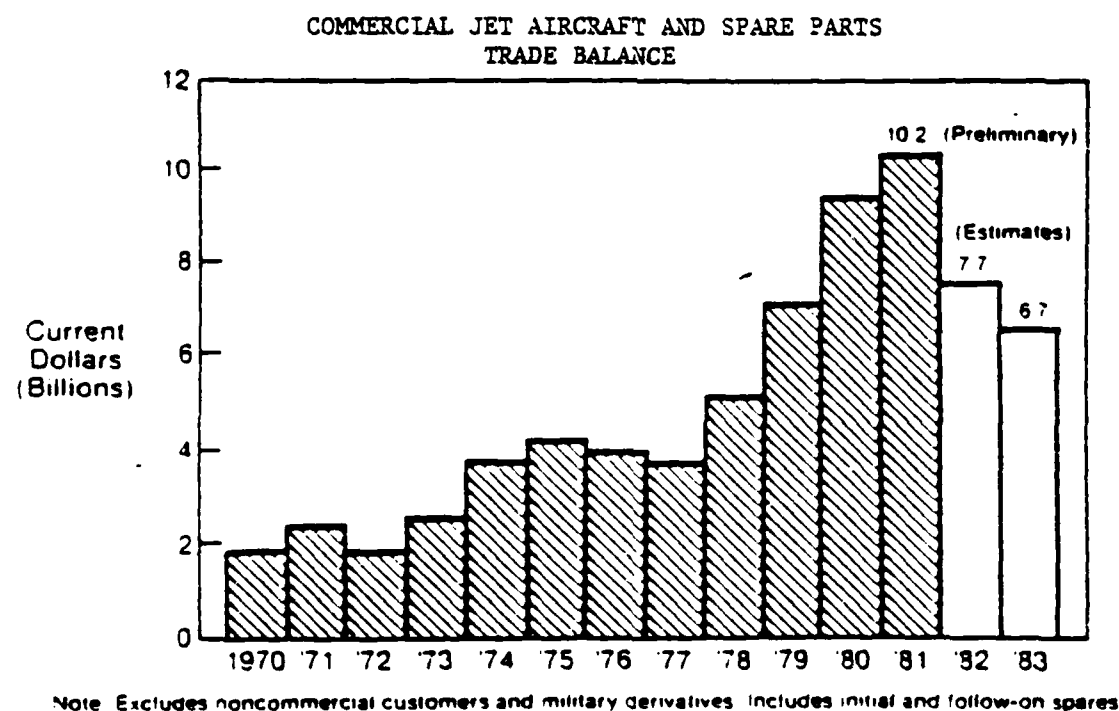


Fig A-11. Net Trade Contribution.(16)

1979 (Figure A-12 below). (17)

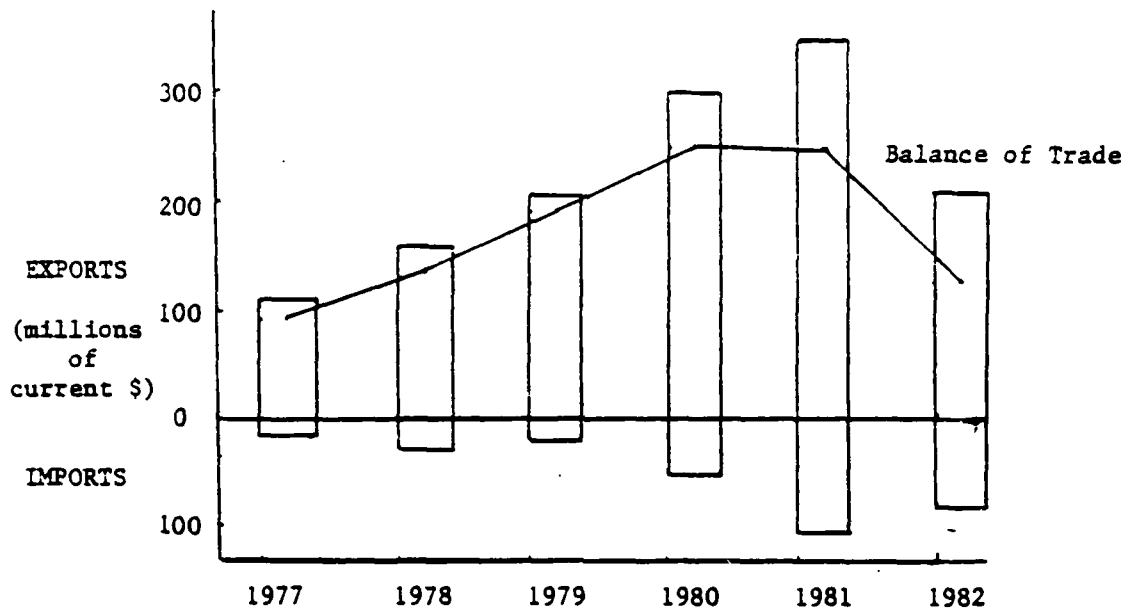


Fig A-12. Balance of Trade in Helicopter Products.

9. Loss of jobs to overseas companies, together with the cyclical employment in the industry, is very costly.

In 1982, 1,220,000 people were directly employed in the aerospace field. Over 650,000 of those workers are counted in the aircraft industry making it the second largest industrial employer (3 digit Commerce code level). It is certainly the largest employer of skilled machinists, engineers and technicians. In addition, there are as many as 400,000 other aircraft workers in related fields (other 3 digit Commerce codes).(18) The concentrations are regional: one company has enormous impact in a given area. The United Technologies Corporation is the largest employer in all of New England. The Boeing Company is the largest employer in the western United States.

Aerospace employs 28% of all U.S. scientists and engineers. Of those employed strictly in research and development, aerospace employs over 20%. Aircraft scientists and engineers accounted for 43% of that aerospace total in 1979. (19)

Employment in the aerospace industry is the most volatile of all the high technology fields. Job levels peaked during the Vietnam War and again in 1980 (Figure A-13).

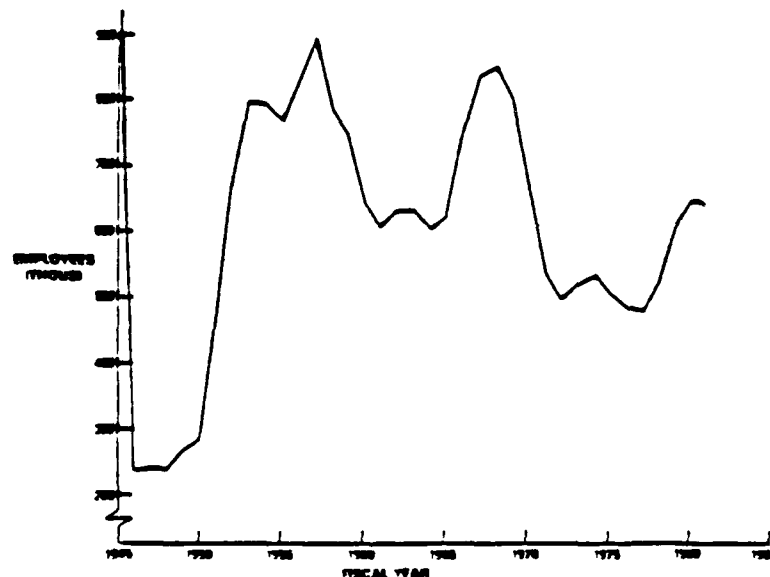
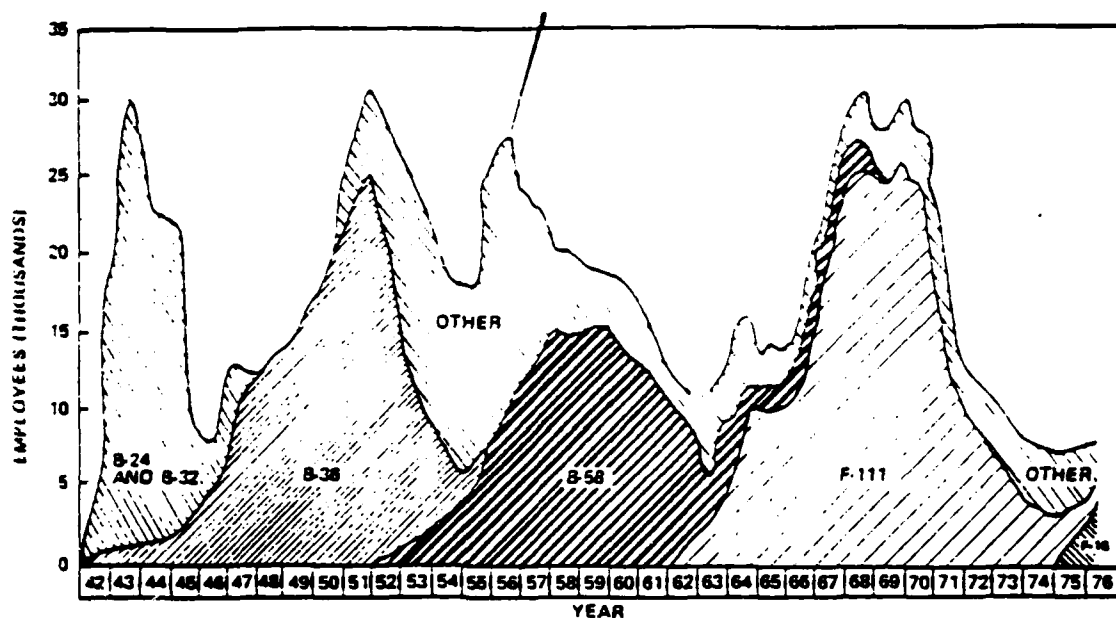
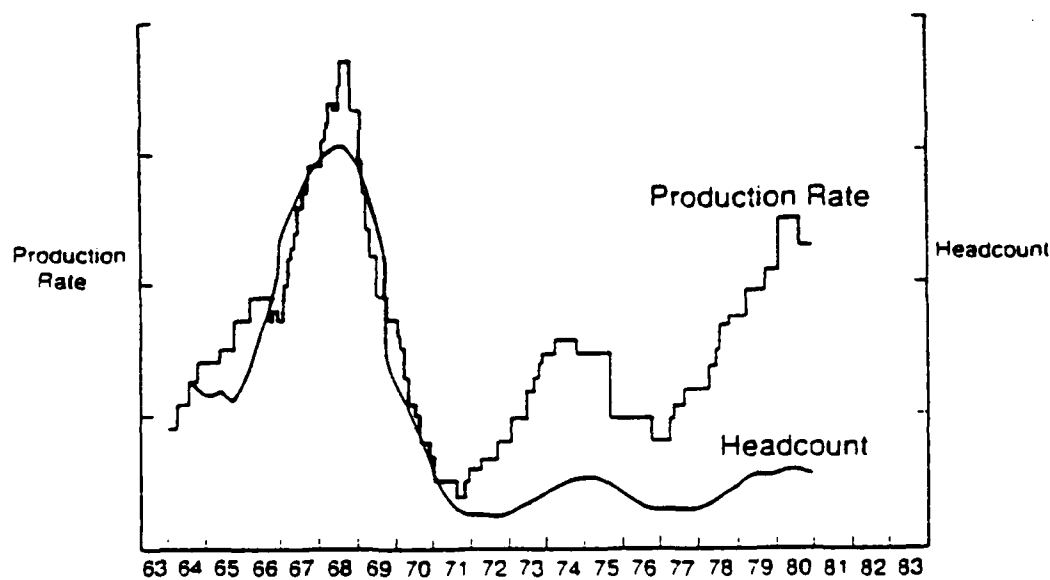


Fig A-13. Aerospace Employment.(20)

Swings in employment have been as high as 50% in production workers, (1977 to 1980), and 20% in scientists, engineers and technicians. Moreover, the separation rates exceeded 30% per year in the five years from 1967 to 1971.(21) An example of the volatile nature of employment in two aircraft plants is given in Figure A-14.



Employment history of Air Force Plant 4, Fort Worth, Texas (courtesy of General Dynamics Corporation)



Boeing Commercial Production of Models 707, 727 and 737 and Associated Employment History

Fig A-14. Employment Histories in two plants

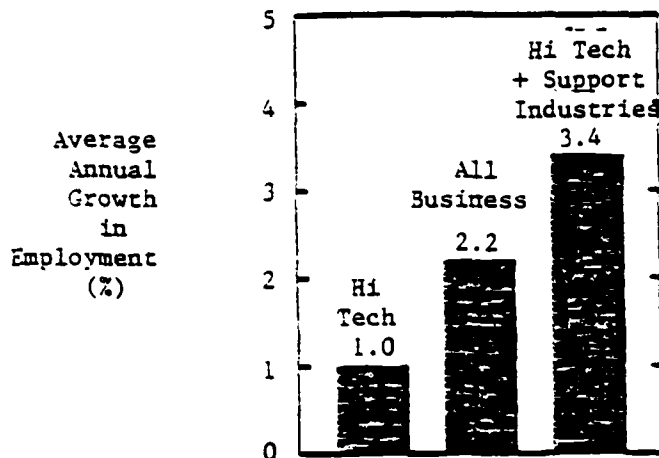
These swings in employment are expensive. Apprentices for skilled

machining typically require over four years of on-the-job training to be federally certified.(23) For aeronautical engineers, the training times may stretch to ten years including their college education. Only about 20% of the work force is considered semi-skilled or unskilled blue collar. In order to attract trained people to the aircraft industry in the face of high instability, companies pay an average of 22% higher wages plus 5-10% additional in training costs.(24) Estimates of lost worker income due to the drop in employment between 1967 to 1971 approach \$2 billion per year plus \$400 million per year in unemployment compensation (1982 dollars).

The net result is that the Department of Defense pays wages to build aircraft that are 30% higher than they need to be. The federal government as a whole loses tax revenue from lost worker income and also pays out unemployment compensation. The taxpayer suffers in dollars and cents, and the lives of many aircraft workers are turned upside down.

9. Loss of leadership can have an impact on U.S. technological innovation.

With the decline of traditional "smokestack" industries, the greatest source of new job creation has been in the so-called high technology industries and the service sector. However, among the nine "hi-tech" industries identified by the U.S. Cabinet Council on Commerce and Trade, the more mature industries such as aircraft were not sources of new jobs in the 1970's. Nevertheless, the aircraft sector did share common ground with the others in its disproportion contribution to research, high productivity and favorable balance of trade. "These benefits have a ripple effect throughout the economy as other industries absorb the new technologies and create new jobs."(25) The high ratio of productivity (6 times the industry average) in



"For every job created in U.S. hi tech industries, 8 jobs are created in sectors that supply it. This job multiplier does not include jobs created in downstream industries whose enhanced competitiveness and productivity results from the the application of hi tech products and related services."²⁷

Fig A-15. Employment Growth 1970 - 1980.(27)

these high technology industries does not create many jobs directly but rather indirectly in its support industry. This is illustrated in Figure A-15.

Because of the sheer size and diversity of the aircraft industry, many new technologies receive a critical boost into maturity that then make them available to other industries at lower risk and cost. Table A-1 lists a few of these diverse technologies. (27)

All of these technologies embody know-how that can be adopted by other industries. Examples of the aircraft industry taking the pioneering lead abound. Extensive research and use launched the wide spread use of carbon fiber composites by lowering their cost. Large scale computer simulation of complex airplane structures led to lighter weight automobiles and construction of huge offshore platforms for oil exploration. The large CRAY computers, powered metallurgy, single crystal structures and turbines for ships, tanks and cruise missiles evolved out of requirements in the aircraft industry.

10. Loss of leadership can adversely affect our standard of living.

Microelectronics

Active Control: Stability, Structural Response, Variable Camber
Propulsion Control
Microprocessors, Displays
Weapons, Voice Actuation
Robotics
RPVs

Materials

Composites, Metal Matrix
Structural Concepts, Stealth
Processing Techniques
High Temperature: Ceramics,
Coatings
Aeroplasticity
Weight, Durability, Fatigue

Aerodynamics Ideas

Vortex Lift Turboprops
Laminar Flow Control Tip Shapes
Circulation Control
Configurations

Large Computers

Numerical Techniques
Computational Fluid Dynamics
Integrated Design, CAD/CAM
Material Structural Analysis
Aeroelastics and Acoustics

Lasers

Experimental Techniques
Navigation
Weapons

Fiberoptics

Controls, Displays

Fluidics

Hydraulics, Actuators

Table A-1. Technologies Exploited by Aircraft Industry.(27)

The aircraft industry is not only "hi-tech" but constitutes "high added value" employment. That requires some discussion. Only when a worker offers a scarce or highly productive contribution to a product can he command high wages in a competitive market. Such workers are almost always found in capital intensive or knowledge intensive industries. Here education, training and experience are the primary basis for high wages (to which can be added drive, ambition, and entrepreneurial spirit). Figure A-17 illustrates the relationship between different industrial mixes where wages and capital are the variables.

Knowledge-intensive industries and their associated service sectors constitute the bulk of U.S. non-commodity exports. Eighty percent of new jobs created in industry are trade dependent.(29) The unskilled labor segments of each industrial sector where there is volume production tend to get exported to low wage countries. This is true of basic steel production, most textiles

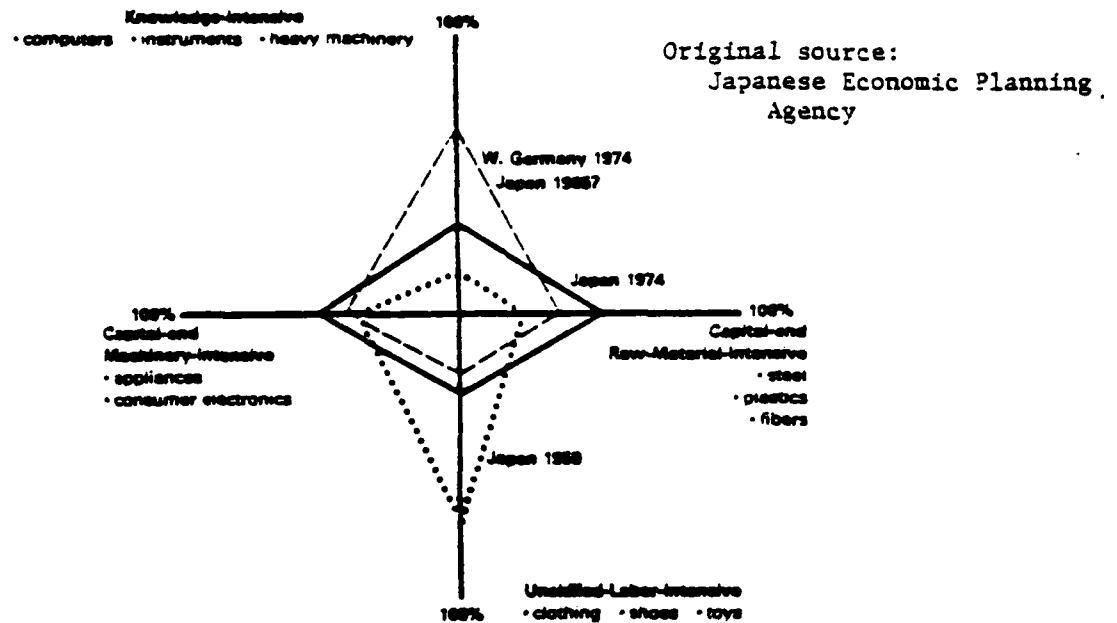


Fig A-17. Mix of Industrial Structure.(28)

and now ATARI computer assembly. To quote Robert Reich of Harvard University: "For competitive survival the United States must train its workers for the highest valued-added segments in all industries. The lower skill ends in every industry are going to move abroad." The sole exception to that statement may be space and aircraft, where there is low volume production.

In the aircraft industry there has been no natural flow of low skills to overseas labor markets. Exceptions such as printed circuits and wiring assemblies may be found but the percentage is tiny. Most of the job loss to overseas markets has been due to the intervention of foreign governments. When this happens, it is equivalent to exporting our standard of living. This is also equivalent to lowering our standard of living if similar high value-added jobs are not available or have been successfully targeted by foreign governments. European countries, Japan and even Brazil and Canada are competing heavily in all the alternate high value-added industries and their

associated service sectors. There is no area left that is exclusively an American industry.

11. The presence of commercial aircraft around the world is no longer synonymous with American prestige and know-how.

European airliners now appear in airports all over the world from Miami to Europe, Africa, the Middle East, Southern Asia and Australia. The Free World's only supersonic transport, the Concorde, clearly demonstrates the currency of French and British technology. The next supersonic civil aircraft could very well be a business jet, built on technology recently developed by NASA but probably funded to production by foreign governments.

Measuring the precise value of this gain in prestige accorded each European country is impossible. However, the indirect benefits can spread to a whole country's exports. The reputation Japan has built in automobiles and consumer electronics carries over to the poorest of its product lines. It has generated an impression that all Japanese products are made with quality. In the case of the Airbus and Aerospatiale helicopters, the prestige has carried over to French military products, the European space program, French telecommunications, subway cars, and even related services such as airport design and construction.

The argument for attaching an economic value to prestige may be weak, but aircraft and space are really the only two major American merchandise exports of recognized quality. We are losing or have lost the competitive edge in machine tools, pharmaceuticals, chemicals and robotics. American products such as automobiles, televisions, ship building, and textiles are recognized overseas for their poor quality or inappropriate marketing or high cost - or

all three. Of our military products American aircraft and missiles are the only major items that enjoy wide-spread demand and acceptance.

Summary

What is to be done? Can anything be done? What is an appropriate response for this country given a broad cultural distaste for government central planning and bureaucracy? Subsequent appendices will examine the tools already used by the federal government, albeit in diverse and sometimes contrary ways. They will also cover French and Japanese industrial policies and the Airbus Industry as a case study. Change is needed, for surely to do nothing is to mortgage our future for a long time to come. Indeed, it may very well threaten our ability to defend our interests around the world.

FOOTNOTES

APPENDIX A (Pages A-1 to A-21)

¹Aerospace Industries Association of America, Inc. (AIA), Aerospace Facts and Figures 1982/83, (McGraw-Hill, 1982), p. 17.

²Barry Bluestone, Peter Jordon and Mike Sullivan, Aircraft Industry Dynamics, (Boston: Culburn House 1981), p. 3 and AIA, Aerospace Facts and Figures p. 18.

³Aviation Week, "FY-83 Aerospace Budget" February 15, 1982, p. 16.

⁴The Boeing Company, International Competition in the Production and Marketing of Commercial Aircraft, May 1982, p. 5.

⁵AIA, Aerospace Facts and Figures, pp. 79, 83.

⁶The Boeing Company, "An Overview of the Boeing Company," May 1982, Trends and Projections section, not paged.

⁷NASA, "Civil Aircraft Market," briefing to OSTP Steering Group, April 22, 1982, not paged.

⁸Office of Science and Technology Policy (OSTP), "Aeronautical Research and Technology Policy," November 1982, Vol. II, pp. 1-20.

⁹NASA, "Civil Aircraft Market," not paged.

¹⁰The Boeing Company, "An Overview of the Boeing Company," not paged.

¹¹"Joint DOD/OMB Study of the U.S. Aircraft Industry," January 1977, p. 19.

¹²Ibid., p. 51.

¹³Jacques S. Gansler, The Defense Industry, (The MIT Press, 1982), p. 266.

¹⁴OSTP, "Aeronautical Research and Technology Policy," Vol. II, pp. 1-21.

¹⁵NASA, "Civil Aircraft Market," not paged.

¹⁶Ibid.

¹⁷AIA, Aerospace Facts and Figures, p. 120.

¹⁸Bluestone, Aircraft Industry Dynamics p. 3.

- ¹⁹AIA, Aerospace Facts and Figures, p. 134, p. 140.
- ²⁰OSTP, "Aeronautical Research and Technology Policy," Vol. II, pp. 1-26.
- ²¹AIA, Aerospace Facts and Figures, p. 136.
- ²²The Boeing Company, "An Overview of the Boeing Company," not paged.
- ²³Bluestone, Aircraft Industry Dynamics p. 133.
- ²⁴*Ibid.*, p. 143.
- ²⁵Cabinet Council on Commerce and Trade, "An Assessment of U.S. Competitiveness in High-Technology Industries," May 19, 1982, p. 3.
- ²⁶*Ibid.*, p. 7.
- ²⁷OSTP, "Aeronautical Research and Technology Policy," Vol. II, p.
- ²⁸Ira C. Magaziner and Robert B. Reich, Minding America's Business, (Harcourt Brace Jovanovich), p. 80.
- ²⁹*Ibid.*

U.S. GOVERNMENT POLICIES AND THE AIRCRAFT INDUSTRY

The Nature of the Country

Business organizations during the history of the United States have taken three fundamental forms: individual proprietorship, the partnership and the corporation. The U.S. aircraft industry has followed the general trend by starting with individual proprietorships and evolving to large corporations. Because they trace origins to fiercely independent individuals, most of the large aerospace corporations still retain an individual character and a strong sense of independence and competitiveness.

Even though the concepts of free enterprise and laissez faire have been widely espoused in the US., the government has exerted more influence over economic and business activity than often admitted. During the early years of the nation, government actions regarding business were largely promotional and protective. Later, government activity became regulatory as attempts were made to curb the abuses of the business world by laws such as the Sherman Antitrust Act. During world War I, the government initiated controls over production and prices. Controls were again adopted in World War II and the Korean War. In the 1960's a new aspect of government control emerged as federal regulations were aimed at improving the quality of life in the areas of safety and health.

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permit fully legible reproduction

It is against this background of American history that the present day U.S. aerospace corporations are operating. These companies remain ruggedly individualistic and wary of government actions because during their lifetimes they have experienced government regulations and controls with little government protection and promotion.

Definitions

The terms aerospace industry and aircraft industry are used in this paper where available statistics warrant. Aerospace includes aircraft, missiles and spacecraft. As a subgroup, aircraft includes engines, airframes, flight controls, avionics and support. The aircraft industry constitutes about half of aerospace business, however, aeronautics per se can pertain to anything from cruise missiles to space shuttles. Avionics for guidance, navigation and weapon systems are usually reported elsewhere and will significantly underestimate the importance of aircraft.

A Brief History

The industry, which traces its beginnings to the wright brothers, has enjoyed an exciting and successful history. During world war II, U.S. aircraft production was a major factor in the outcome of the war. Two hundred thousand aircraft were built during the four year war period with

26,318 completed in 1944 alone. Although employment and production levels dropped after World War II, the large research and industrial base built up during the war enabled the U.S. to lead the world in developing jet combat aircraft and dependable, efficient commercial airliners. However, the nation has not always appreciated the importance of a strong aircraft industry. The U.S. entered World War I and World War II far behind the rest of the world. On the eve of World War I, France was reported to have 1,400 airplanes, Germany 1,000, Russia 800, Great Britain 400, and the U.S. 23. However, since World War II, the U.S. has maintained its position as the acknowledged leader in aviation setting standards of excellence in both military and commercial aircraft.

The result has been that U.S. aircraft are flown by most of the free world's major airlines and the sale of aircraft and aircraft related items has been a major contributor to a favorable balance of trade for the U.S. In the last five years, the U.S. has experienced an annual trade deficit of \$145 billion which was offset by an aerospace trade surplus of \$51 billion. However, the current recession, deregulation of U.S. airlines and foreign competition are contributing to a situation that is causing the U.S. aircraft industry to lose its leadership in commercial aircraft. Orders for large passenger aircraft from U.S. manufacturers fell from 627 in 1978 to 251 in 1981. Employment in the manufacturing of large commercial aircraft fell from 100,000 in December, 1979, to 64,000 in December, 1981, and is expected to drop to 70,200 by the end of 1983.¹

The Present Industry

The present U.S. aircraft industry consists of approximately thirty corporate organizations with production facilities distributed in several regions of the country. Several of the larger manufacturers produce both military and civil aircraft or major subassemblies. The major U.S. aircraft companies are listed below:

Military and Commercial

Boeing

Fairchild

General Dynamics

Grumman

Lockheed

McDonnell Douglas

Northrop

LTV

Helicopters

Bell

Hughes

Kaman

Sikorsky

General Aviation

Beech

Cessna

Piper

In 1982, Lockheed announced that upon completion of present orders, the L-1011 Tristar commercial aircraft program would be terminated. The reasons given for termination were the large financial losses incurred by the program and the dim prospects for future profits. Lockheed figures show a \$280 million loss on the L-1011 in 1981 and a \$2.5 billion loss on the entire program. The exit of Lockheed from the commercial aircraft market leaves only two U.S. manufacturers: Boeing and McDonnell Douglas producing large commercial airliners.

Government Domestic Policies

The policy of the U.S. government regarding the aircraft industry has never been formalized but in general the unwritten policy has been to encourage the industry's health and prosperity. The goals of government policy can be described as follows:

- Encourage economic efficiency and technical advances
- Maintain competition
- Retain a surge mobilization capability

To promote these goals, the U.S. government has favored the industry by three general programs:

- Research and development (R&D) funding
- Government subsidized facilities and equipment
- Favorable purchasing procedures

Research and Development

In 1978 the government funded approximately 76 percent of research and development in the aircraft industry.² By comparison, only one percent of the research budget of the pharmaceutical industry is funded by the government.³ According to the Aerospace Industries Association, the industry performs over 20 percent of all research and development in the United States. Undoubtedly, this R&D has contributed to the technological edge maintained by the U.S. aircraft industry. It is interesting to note that Japan, with its highly directed government industrial programs, funds only 16 percent of its research and development.⁴

Table B-1 depicts the large percentage of net sales that the industry has been investing in R&D. This large R&D investment is required in an industry which is continually improving its product and where contracts and sales are usually awarded to the advanced design promising the highest performance and reliability. Table B-1 shows a steady decrease in the percent of net sales spent on R&D in recent years.

Table B-2 depicts government R&D funding for all industries compared to the aerospace industry. In 1964, federal funds represented 91.1 percent of the total aerospace R&D amount. In 1982 it is estimated that government funds represented 74 percent of aerospace R&D funds.

Since 1964, aerospace R&D as a percentage of net sales as well as the government's share of aerospace R&D has been decreasing. It is speculated that this decline in U.S. government support for aerospace R&D has been one of the reasons for the emergence of large multinational ventures. It is reported that in the development of the CFM56 engine by GE/Snecma, the French government contributed 50 percent of the \$500 million required for R&D.⁵ The CFM56 uses the GE engine core designed for the B-1 bomber and Snecma developed fan. The engine is assembled in both France and the U.S. and has been purchased by American airframe manufacturers and the U.S. government.

It appears that if the U.S. capital markets will not provide the necessary funds and R&D support through mechanisms of one type or another, U.S. aircraft manufacturers will seek arrangements with foreign companies having access to such support.

Table B-1

AEROSPACE FACTS AND FIGURES 1982/83

RESEARCH AND DEVELOPMENT FUNDS AS PERCENT OF NET SALES
ALL MANUFACTURING INDUSTRIES AND THE AEROSPACE INDUSTRY

Calendar Years 1967-1980

Year	All Manufacturing Industries ^a		Aerospace Industries ^b	
	Total R&D Funds as Percent of Net Sales	Company R&D Funds as Percent of Net Sales	Total R&D Funds as Percent of Net Sales	Company R&D Funds as Percent of Net Sales
1967	4.2%	2.1%	19.7%	4.0%
1968	4.0	2.1	19.0	4.1
1969	4.0	2.2	20.2	4.6
1970	3.7	2.2	16.2	3.8
1971	3.5	2.1	16.2	3.4
1972	3.4	2.0	16.6	3.3
1973	3.3	2.0	13.3	3.0
1974	3.1	2.0	14.1	3.5
1975	3.1	2.0	12.7	2.8
1976	3.1	2.0	12.7	2.8
1977	3.1	2.0	12.8	2.8
1978	3.2	2.1	12.2	3.0
1979	3.0	2.1	11.4	3.2
1980	3.1	2.2	11.6	3.3

Source: National Science Foundation

^a Includes all manufacturing industries known to conduct or finance research and development.^b Companies classified in SIC codes 372 and 376 having as their principal activity the manufacture of aircraft, guided missiles, space vehicles and parts.FUNDS FOR ENERGY RESEARCH AND DEVELOPMENT
ALL INDUSTRIES AND THE AEROSPACE INDUSTRYCalendar Years 1977-1981
(Millions of Dollars)

	1977	1978	1979	1980	1981 ^E
All Industries ^a — TOTAL	\$2,599	\$3,026	\$3,795	\$4,366	\$4,753
Federal Funds	951	1,193	1,497	1,669	NA
Company Funds	1,648	1,833	2,298	2,697	NA
Aerospace Industry ^b — TOTAL	\$ 165	\$ 263	\$ 372	\$ 441	\$ 394
Federal Funds	108	215	259	295	NA
Company Funds	57	68	113	146	NA

Source: National Science Foundation

^a Includes all manufacturing industries, plus those non-manufacturing industries known to conduct or finance research and development.^b Companies classified in SIC codes 372 and 376 having as their principal activity the manufacture of aircraft, guided missiles, space vehicles and parts.

NA Not available

^E Estimated by surveyed companies.

Table B-2

FUNDS FOR RESEARCH AND DEVELOPMENT
ALL INDUSTRIES AND THE AEROSPACE INDUSTRY

Calendar Years 1968-1982
(In Millions of Dollars)

Year	All Industries ^a			Aerospace Industry ^b		
	Total	Federal Funds	Company Funds ^c	Total	Federal Funds	Company Funds ^c
CURRENT DOLLARS						
1968	\$17,429	\$ 8,500	\$ 8,869	\$ 5,765	\$4,533	\$1,230
1969	18,308	8,451	9,857	5,852	4,524 ^r	1,354
1970	18,067	7,779	10,288	5,219	4,005	1,213
1971	18,320	7,666	10,654	4,881	3,864	1,017
1972	19,552	8,017	11,535	4,950	3,970	978
1973	21,249	8,145	13,104	5,052	3,899	1,154
1974	22,887	8,220	14,667	5,278	4,000	1,278
1975	24,187	8,605	15,582	5,713	4,428	1,285
1976	26,997	9,561	17,436	6,339	4,921	1,418
1977	29,928	10,521	19,407	7,104	5,541	1,563
1978	33,365	11,209	22,156	7,690	5,811	1,879
1979 ^r	38,147	12,492	25,655	8,290	5,997	2,293
1980 ^r	43,879	13,939	29,940	9,626	6,896	2,730
1981 ^E	49,600	15,750	33,850	9,814	7,860	1,954
1982 ^E	55,700	17,800	37,900	12,244	9,055	3,187
CONSTANT DOLLARS (1972 = 100)						
1968	\$21,116	\$10,371	\$10,745	\$5,994	\$5,492	\$1,490
1969	21,095	9,737	11,357	6,778	5,213	1,550
1970	19,756	8,506	11,250	5,707	4,379	1,326
1971	19,081	7,985	11,097	5,084	4,025	1,059
1972	19,552	8,017	11,535	4,950	3,970	978
1973	20,105	7,707	12,399	4,780	3,689	1,092
1974	19,916	7,153	12,763	4,593	3,481	1,112
1975	19,263	6,851	12,410	4,550	3,527	1,023
1976	20,435	7,237	13,198	4,798	3,725	1,073
1977	21,403	7,524	13,879	5,080	3,953	1,118
1978	22,236	7,470	14,766	5,125	3,873	1,252
1979	23,436	7,675	15,762	5,093	3,634	1,409
1980	24,740	7,859	16,881	5,427	3,858	1,539
1981 ^E	25,605	8,131	17,474	5,036	4,057	1,009
1982 ^E	26,663	8,521	18,143	5,861	4,335	1,526

Source: National Science Foundation, for historical data and All Industries estimates; Battelle Memorial Institute, "Probable Levels of R&D Expenditures: Forecast and Analysis," (Annually) for Aerospace Industry estimates; "Economic Report of the President," (Annually) and "The Budget of the United States Government," (Annually) for GNP deflator series used to calculate constant dollar values.

NOTE: Details may not add to totals because of rounding.

- ^a Includes all manufacturing industries plus those non-manufacturing industries known to conduct or finance research and development.
- ^b Companies classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles, and parts.
- ^c Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other non-profit organizations.
- ^r Revised.
- ^E Estimate.

There exists some adverse aspects to this situation. In addition to becoming dependent on foreign governments there is the danger of unwanted technology transfer. Because of the B-1 derivation, the CFM56 program was somewhat constrained at first by U.S. military security. That problem has now been resolved by independent work on separate portions of the engine but it is probable that a mutual transfer of technology took place.

Plant and Equipment

At the beginning of World War II, it became evident that a rapid expansion of the industry was required. The U.S. government offered special incentives and a variety of economic concessions to the industry. Rapid depreciation schemes allowed companies to depreciate newly constructed plants over the space of 5 years for tax purposes, as compared to the normal 20 or 30 year period. Incentives and concessions such as rapid depreciation were still not enough to encourage the construction of large aircraft factories which were finally built at public expense and leased to the companies. After the war the government was unable to convince companies to purchase the factories as the aircraft business decreased. The result has been that some companies such as General Dynamics and Lockheed still continue to lease factories from the government. In this manner the fixed cost of owning a large facility outright is avoided. Additionally, some state property taxes may be avoided.

It is estimated that the aircraft industry expended only 10 percent of the total funds for expansion in World War II while the government financed the remaining 90 percent. Similarly the industry furnished only one third of the funds for expansion during the Korean War.⁶ It is reported that the number of government owned plants had been reduced from 288 in 1954 to 189 by 1972.⁷ The largest sale was the transfer of Air Force Plant No. 13 in Wichita to the Boeing Co. in 1979 for \$44.75 million. Boeing now owns all of its plant facilities. One of the largest plants still owned by the government is Air Force Plant No. 4 in Fort Worth, Texas. The 40 year old facility has a mile long assembly line which is leased by General Dynamics to build F-16 fighters. Approximately one-third of the current plant space and a significant share of the manufacturing equipment is still owned by the U.S. government.⁸

Purchasing Procedures

In 1950, the U.S. government purchased 92 percent of all U.S. aircraft sales.⁹ Although the government continues to account for a large amount of the sales, the percentage has dropped to 46 percent in 1981. Table B-3 is a listing of industry sales showing the portion purchased by the government.

Due to the fact that government procurement of military aircraft tends to demand state-of-the-art designs and in

Table B-3

SALES OF MAJOR AEROSPACE COMPANIES
AS REPORTED BY THE BUREAU OF THE CENSUS

Calendar Years 1968-1981
(Millions of Dollars)

Year	GRAND TOTAL	TOTAL		Aircraft, Engines, and Parts		Missiles & Space Incl. Propulsion	Other Aerospace		Non- Aero- space
		U.S. Gov't.	Other	U.S. Gov't.	Other		U.S. Gov't.	Other	
CURRENT DOLLARS									
1968	\$25,572	\$16,635	\$ 8,957	\$ 7,411	\$ 6,439	\$6,076	\$2,077	\$1,040	\$ 2,549
1969	24,648	16,560	8,068	7,161	5,603	5,660	2,539	986	2,699
1970	24,752	16,407	8,345	7,596	5,880	5,422	2,324	896	2,644
1971	21,679	14,114	7,565	6,313	5,079	4,971	1,909	884	2,523
1972	21,499	13,492	8,007	4,954	5,199	5,598	2,067	1,035	2,646
1973	24,306	14,431	9,874	5,539	6,739	5,580	2,103	1,001	3,343
1974	26,849	15,196	11,653	5,982	7,560	5,854	2,101	1,285	4,067
1975	29,473	17,314	12,159	6,559	7,797	6,310	2,070	1,645	4,792
1976	31,323	19,083	12,245	6,314	7,622	5,650	2,223	1,933	5,311
1977	33,315	20,704	12,611	8,848	7,530	5,775	2,639	2,219	6,104
1978	37,908	21,898	16,080	8,724	10,581	6,380*	3,363	2,107*	6,813
1979	46,173	23,229	22,944	8,649	16,023	7,197	3,930	2,659	7,715/
1980*	58,440	26,674	31,766	9,427	20,097	8,393	6,869	2,609	11,045
1981*	70,536	32,504	38,032	12,168	22,527	9,842	8,170	3,120	14,709
CONSTANT DOLLARS (1972 = 100)*									
1968	\$31,006	\$20,154	\$10,852	\$8,979	\$ 7,801	\$7,351	\$2,516	\$1,250	\$3,088
1969	28,400	19,081	9,319	8,251	6,456	6,521	2,925	1,136	3,110
1970	27,036	17,941	9,125	8,295	6,430	5,929	2,541	990	2,891
1971	22,580	14,701	7,679	6,575	5,290	5,178	1,558	921	2,628
1972	21,499	13,492	8,007	4,954	5,199	5,598	2,067	1,035	2,646
1973	22,906	13,654	9,342	5,241	6,376	5,280	1,990	947	3,163
1974	23,363	13,223	10,140	5,205	6,578	5,094	1,828	1,118	3,539
1975	23,473	13,789	9,684	5,463	6,210	5,025	1,649	1,310	3,817
1976	23,714	14,445	9,269	6,293	5,769	4,451	1,792	1,358	4,020
1977	22,225	14,807	9,019	6,328	5,385	4,130	2,030	1,587	4,365
1978	25,304	14,587	10,716	5,814	7,052	4,252	2,241	1,404	4,540
1979	28,367	14,271	14,096	5,314	9,844	4,422	2,414	1,634	4,740
1980	32,950	15,039	17,910	5,315	11,331	4,732	3,873	1,471	6,227
1981	36,413	16,780	19,633	6,282	11,629	5,081	4,218	1,611	7,593

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quartely).

^a AIA estimate based on MQ37D data.

^b The Bureau of the Census has issued a downward revision for first and second quarter data by a total of \$1,947 million, such that the revised level of 1981 annual sales amounts to \$68,583. Product group detail is not yet available for the revised totals.

^c Based on GNP implicit price deflator.

^d Revised.

many cases pushing the limits of technology, estimation of cost in advance of production is difficult. During World War II the "cost-plus-percentage-profit" contract was used to encourage new advances in aeronautics. Companies were paid a predetermined percentage of total costs as profit. Naturally this type of an agreement meant that firms would keep costs as high as possible.

The "cost-plus-fixed-fee" contract has replaced the "cost-plus-percentage-profit" contract in government aircraft purchases. This method pays the company a fixed, absolute profit, regardless of the level of final costs. During the time when Robert McNamara was Secretary of Defense a "total-fixed-price" contract was introduced. McNamara also developed the Total Package Procurement Concept (TPPC) which required contractors to incorporate the entire development and production cost of an aircraft or missile in their original bids. Inflation of the 1960's caused huge cost overruns and aircraft companies were forced to absorb increased costs at a loss under fixed price contracts. Shortly thereafter cost-plus-fixed-fee contracts were reinstated, again giving aircraft manufacturers a guaranteed profit.

Recent trends in defense contracting tend toward cost-plus-incentive fee during the high risk research and development phase and firm-fixed-price contracts during the more predictable production phase. Cost-plus-incentive fee contracts cover all of the contractors costs plus a fee which varies with his performance during the development phase. Some contracts are written so that the contractor receives a portion of

of the savings if an R&D project is completed under the predicted budget.

Critics will argue that no other industry enjoys a guaranteed profit such as provided by the cost-plus-fixed-fee government contract. Defenders of the aerospace industry point out that the demands for new technology make it impossible to estimate the cost of experimental work and a profit incentive is required before anyone will undertake a project that investigates the limits of technology. Nevertheless, the cost plus guaranteed fixed profit has the potential of shielding the aircraft industry from its own mistakes, inefficiencies and waste. Table B-4 lists the net value of prime contracts awarded to major aerospace companies.

Foreign Trade

Perhaps the most important aspect of the U.S. aerospace industry is the large contribution that it makes to the well being of the U.S. economy. In 1971, the United States experienced the first negative balance of trade since 1888. Since 1971, the U.S. has shown a negative balance of trade for every year except 1973 and 1975 when large aerospace sales produced favorable balances. In 1981, the trade deficit was over \$30 billion softened primarily by a \$13 billion net export of aerospace products. Table B-5 lists the U.S. balance of trade figures since 1960 and the corresponding aerospace contribution.

Table B-4

AEROSPACE FACTS AND FIGURES 1982/83

DEPARTMENT OF DEFENSE MAJOR CONTRACTORS

Fiscal Years 1977-1981
 Listed by rank according to net value of
 prime contracts awarded during last fiscal year^a
 (Millions of Dollars)

Company	1977	1978	1979	1980	1981
TOTAL CONTRACTS	\$50,385	\$59,582	\$63,252	\$76,807	\$97,389
McDonnell Douglas Corp.	2,574	2,863	3,229	3,247	4,409
United Technologies Corp.	1,585	2,400	2,554	3,109	3,776
General Dynamics Corp.	1,372	4,154	3,492	3,518	3,402
General Electric Co.	1,520	1,786	2,042	2,202	3,018
Boeing Co.	1,580	1,525	1,515	2,385	2,683
Lockheed Corp.	1,673	2,226	1,797	2,037	2,657
Hughes Aircraft Co.	1,093	1,489	1,557	1,819	2,552
Raytheon Co.	1,041	1,307	1,249	1,745	1,826
Grumman Corp.	1,428	1,180	1,364	1,322	1,710
Chrysler Corp.	620	743	809	971	1,414
Litton Industries, Inc.	609	1,557	832	652	1,385
Martin Marietta Corp.	426	539	519	809	1,287
Philbro Corp.	(a)	(a)	(a)	(a)	1,223
Exxon Corp.	238	311	341	480	1,152
Tenneco Inc.	745	407	1,093	1,524	1,151
Rockwell International Corp.	1,480	890	634	669	1,126
Westinghouse Electric Corp.	802	539	660	932	1,125
FMC Corp.	245	361	352	835	1,052
Standard Oil Co. of CA.	297	244	241	475	972
Sperry Corp.	652	612	779	845	928
RCA Corp.	364	565	487	589	877
Honeywell Inc.	457	545	658	687	838
IBM Co.	547	396	553	497	805
AT & T Co.	457	457	570	597	695
Texas Instruments Inc.	324	434	374	431	625
Northrop Corp.	1,047	586	800	1,227	623
General Motors Corp.	380	420	449	509	622
Coastal Corp.	84	154	178	250	616
Motor Oil Hellas	(a)	(a)	184	1,059	583
Singer Co.	350	282	346	435	565

Source: Department of Defense, "100 Companies and Their Subsidiary Corporations Listed According to Net Value of Prime Contract Awards," (Annually).

- ^a Effective 1983, data include DOD contract awards for civil functions, while data for prior years were limited to military prime contract awards.
- ^b Not in top 100 companies for the listed year.

Table B-5

FOREIGN TRADE

TOTAL AND AEROSPACE BALANCE OF TRADE

Calendar Years 1950-1981

(Millions of Dollars)

Year	TOTAL U.S. Trade Balance ^a	Aerospace			Aerospace Trade Balance as Percent of U.S. Total
		Trade Balance	Exports	Imports	
1960	\$ 5,369	\$ 1,665	\$ 1,726	\$ 61	31.0%
1961	6,096	1,501	1,653	152	24.6
1962	4,180	1,795	1,923	128	42.9
1963	6,061	1,532	1,627	95	25.3
1964	7,555	1,518	1,608	90	20.1
1965	5,875	1,459	1,618	159	24.6
1966	4,524	1,370	1,673	303	30.3
1967	4,409	1,961	2,248	287	44.5
1968	1,133	2,661	2,994	333	234.9
1969	1,599	2,831	3,138	307	177.0
1970	2,834	3,097	3,405	308	109.3
1971	- 2,024 ^b	3,630	4,203	373	c
1972	- 6,351	3,230	3,795	565	c
1973	1,222	4,360	5,142	782	356.8
1974	- 2,996	6,350	7,095	745	c
1975	9,630	7,045	7,792	747	73.2
1976	- 7,786	7,267	7,843	576	c
1977	- 28,970	6,850	7,581	731	c
1978	- 31,786	9,058	10,001	943	c
1979	- 27,260	10,123	11,747	1,624	c
1980	- 27,340 ^f	11,952	15,506	3,554	c
1981	- 30,051	13,134	17,634	4,500	c

Source: Bureau of the Census, "Highlights of U.S. Export and Import Trade," Report FT990 (Monthly); "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually); "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).

a U.S. Balance of Trade is the difference between exports of domestic merchandise, including Department of Defense shipments, and imports for consumption (customs value base).

b First negative U.S. Balance of Trade since 1888.

c Not applicable.

f Revised.

Government Policies to Promote Trade

One of the challenges to U.S. aircraft manufacturers has been low interest financing provided by foreign governments for customers of their companies. In the past, competitive financing situations have been countered by guaranteed financing provided by the U.S. Export-Import (EXIM) bank.

The EXIM Bank is authorized to have outstanding at any one time dollar loans, guarantees, and insurance in aggregate amount not in excess of \$40 billion. The Bank is also authorized to have a capital stock of \$1 billion and to borrow from the United States Treasury up to \$6 billion outstanding at any one time.

The Reagan Administration proposed reducing the lending authority of the EXIM Bank because at current rates, the was losing money. The EXIM bank borrows money from the Federal Financing Bank, the centralized Treasury agency that handles most federal government off-budget lending. The EXIM's recent money cost it two or three percentage points more than the rates on export loans. Because of this situation, the EXIM's surplus in revenues dropped in 1981 and a loss of as much as \$100 million may have occurred in 1982. If so, this will be the first loss of the EXIM since its founding in 1984.⁹

On the other hand, export sales that can be assured only by the use of the EXIM Bank have a multiplication effect

in the U.S. economy. As an example, the Bank lent Boeing \$5.4 billion directly and guaranteed \$1.8 billion to finance aircraft sales from 1961 through 1980. These sales generated \$15.5 billion in exports or a 2:1 leverage.¹⁰

It appears that foreign governments will continue to provide low interest rates to subsidize their aircraft such as the reported \$100 million French subsidy on the Airbus sale to Eastern Airlines. Until an alternative to the EXIM bank can be found, the U.S. should examine ways to use the bank more effectively.

Conclusion

U.S. aerospace corporations are independent, individualistic companies who are reluctant to align with each other in mutual support due to their historic competition and fear of anti-trust legislation. A national economic strategy such as the Japanese use would be difficult to impose or reach a voluntary agreement on. In any case, the Federal government should adopt a more protective and promotional role regarding this crucial national asset, the aerospace industry. Our national economy, defense and survival may depend on it.

FOOTNOTES

APPENDIX B (Pages B-1 to B-17)

¹Michael Doan, "Aircraft Industry Takes a Nose Dive," U.S. News & World Report, 24 May 1982, p. 64.

²Barry Bluestone, Peter Jordon and Mike Sullivan, Aircraft Industry Dynamics, (Boston: Auburn House Publishing Company, 1981) p. 159.

³Robert B Reich, "Making Industrial Policy," Foreign Affairs, Spring 1982, p. 864.

⁴Ibid.

⁵Bluestone, Aircraft Industry Dynamics, p. 160.

⁶Ibid., p. 163.

⁷Ibid.

⁸Myron Struck, "Pentagon Factory Disposals Running Down," The Washington Post, 17 November 1982. p. A17.

⁹Reich, Foreign Affairs, p. 865.

¹⁰William H. Gregory, "Resuscitating an Old Idea," Aviation Week & Space Technology, 2 March, p. 1.

¹¹Ibid.

FRENCH POLICY

The purpose of this study is to examine French national support for its aerospace industry to see if there are policy lessons for the United States. The aerospace industry is a key high technology industry in both military and commercial markets, for both countries. As described separately, the U.S. aerospace industry is having trouble, both due to the world-wide recession and to the loss of traditional predominance in world commercial aircraft sales. This has generated great concern and a search for the causes, as well as for policy options to correct the decline.

The French aerospace industry now ranks second only to that of the U.S. in the free world, a major accomplishment. France's nationalized and heavily government supported approach seems to offer a stark contrast to the U.S. private industrial approach, and thus offers a useful comparison.

The study concentrates on commercial and military aircraft and aircraft engine manufacturers, not on avionics, rockets or space development. It begins with a brief review of the French setting, including the government, the economy and the aircraft industry. French industrial policy is then examined and reviewed for implications for the U.S. The paper concludes with a summary and policy recommendations.

THE FRENCH SETTING: ECONOMIC AND INDUSTRIAL BACKGROUND

In 1945, France had been the battleground for two world wars. In order to rebuild its economic infrastructure, government involvement and support was essential. Thus began a formal French government planning effort and the design of the First Economic Plan (1947-1953). Priority was given to the basic areas: coal, electricity, steel, cement, farm machinery and

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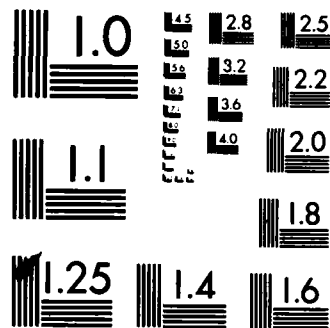
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MICROCOPY RESOLUTION TEST CHART
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transportation. All targets were met or exceeded in 1953, except for the production of tractors. Building on this success the French have continued with economic plans of greater and greater sophistication up to the present.

It is important to note that this is not the rigid state planning of the Soviet model.

"French planning has been characterized from the start by the search for a middle path between obedience to the sometimes arbitrary rules of the free market and recourse to permanent state curbs on the economy. It is coherent, but also flexible and indicative, as well as active and democratic in its drafting and implementation process.(1)"

Because it is not rigidly enforced, French planning is often referred to as, "indicative" planning.

Plans are formed in consultation between industry, labor and government. Although there is not always agreement, the experience of setting goals and measuring output against the plan has meant that French industrial experience has been a joint undertaking since World War II. The French government uses the effective lever of public investment to support the plan, as well as taxes, credits and subsidies. (2) At the same time, French industry, which is composed of a mix of private and nationalized companies, has at times either under-or overproduced the plan. And at times, the plan has had to be adjusted.

With regard to its effectiveness, there appears to be no way to prove that economic planning or any other single factor is the cause for economic success. However, one should note that France now ranks fourth behind the U.S., Japan, and West Germany, as a major industrial power. (3) Its growth since World War II has been exceptional. For example, in the period 1960 -

1980 its real economic growth rate exceeded that of all Western economies except Japan. (4)

Economic planning by a government is, of course, subject to the political process. After 20 years of conservative "Gaullist" rule, a new government under President Francois Mitterrand is in power, with a new set of objectives. In particular, Mitterrand is interested in the correction of social inequities and greater distribution of wealth. One key instrument for Mitterrand is greater nationalization. Under the February, 1982 Nationalization Law, the government increased its share of the industrial base from 18% to 32%. (5) Significantly, 39 banks were nationalized, including even the famous family bank, Banque Rothschild.

Recent years have seen considerable slowing of growth in France. In 1979, gross domestic product increased at a rate of 3%, unemployment was at 5.9% and inflation stood at 10%. In 1980, these figures were 0.5%, 7.6% and 14%, respectively. (6) The Franc has now been devalued three times to cut down a large import surplus and in March inflation was running at 4%. (7)

THE FRENCH SETTING: FRENCH AEROSPACE

While Mitterrand's policies are being implemented in a faltering economy, France's commitment to continued support for its high technology defense industry and for French aerospace, has not changed. This reflects a national consensus formed after World War II, that France would never again be so vulnerable to attack. (8) It also reflects an awareness that aerospace is a high value-added industry which contributes significantly to the French economy. France's attitude was best personified by de Gaulle, who set his country on course to compete with the superpowers in aerospace. Mitterrand's

attitude in support of aerospace reflects this historical approach, although he apparently had some initial moral doubts about arms exports. However, he had to deal with the reality of export earnings and jobs. French arms are 1/10 of the world's arms market (\$6 billion in 1981), and the French arms industry supports 300,000 jobs. (9)

Turning to the French aircraft industry, its firms have combined over the years leaving only four at present, three of which are nationalized. In total, they employed 113,000 workers in 1981. (10)

The two aircraft manufacturers are Aerospatiale and Avions Marcel Dassault-Breguet Aviation. Aerospatiale represents France in the Airbus Industrie consortium and produces about 50% military and 50% civilian aerospace products, ranging from helicopters, to the Ariane space launcher, and missiles such as the Exocet anti-ship missile used by the Argentines in the Falkland's conflict. Aerospatiale was organized in 1970 and is 75% government owned.

Dassault-Breguet, which was nationalized under Mitterrand, is the combination of the Dassault company (which produces the famous Mirage family of fighter aircraft), and Breguet, which produced for example, the Atlantic maritime patrol aircraft. Dassault-Breguet has worked with the United Kingdom to produce the Jaguar, and with West Germany to produce the Alpha Jet trainer/attack aircraft. The Mirage fighters have of course been particularly successful as exports. According to British figures, the Argentines lost 26 Mirage III and V aircraft in the Falklands. (11)

The other two firms are engine manufacturers. Snecma, in which United Technologies, Pratt & Whitney has a small interest, is 90% government owned.

It is producing 27% of the CF6-50 engines for the A300 and A310 Airbus, under license from General Electric. Turbomecca, which is privately owned, specializes in engines for general aviation and helicopters.

INDUSTRIAL POLICY ANALYSIS: NATIONALIZATION

Having reviewed the setting, it is possible to look at French industrial policy in the context of aircraft and aircraft engine manufacturers. The most obvious difference between the French and American industries is the nationalized sector in France, now fully 1/3 of their overall industry, and 3/4 of their aircraft and aircraft engine producers. While there is at least one measurable cost of nationalization, and Mitterrand's government has spent \$6.8 billion to purchase control of previously private firms, it is difficult to weigh effectiveness. In the case of Dassault, it had been extremely successful as a private firm under the guidance of Marcel Dassault. Mr. Dassault, now 90 years old, remains as a technical adviser to his old company. It is indicative perhaps of the French attitude toward cooperation with the government, that Dassault gave the French government the 26% of Dassault-Breguet stock which enabled it to obtain majority control. (12)

Aerospatiale, on the other hand, has been successful as a public firm. However, as the recession inhibits government investment, Aerospatiale is investing some \$200 million of its own funds in 1982, in new aircraft development. The President of Aerospatiale, Jacques Mitterrand, sounds like the President of Boeing when he says, "If we do not continue to upgrade our production techniques and make our manufacturing more efficient, we will lose ground to our competitors." (13,14)

Finally, the private firm, Turbomecca, has indicated that new government financing is required to support new engine development for helicopters, and fixed-wing aircraft. If this funding is not available, their development effort will be reduced.

Certainly French industrial experience since World War II has led them to be comfortable with close government/industry relationships and with mixed private and public ownership of firms. In the case of the aircraft industry, high risk is endemic and both the military and civilian sectors experience significant peaks and valleys in demand. With a relatively small domestic market, government financial support is sought. For example, it is estimated that \$1.85 billion is necessary to develop the new Airbus 320. However, it is not clear that there is a right or wrong way to organize. If public funding is the really critical factor, then the government can clearly give financial support to either a nationalized firm such as aerospatiale or to a private firm such as Turbomecca. On the other hand, the government wishes to direct a firm and control it as a national asset so that its decisions will always reflect the political consensus, then nationalization is more justified. This is the case under President Mitterrand.

INDUSTRIAL POLICY ANALYSIS: "INDICATIVE" PLANNING

This leads us to French government planning and investment. Certainly, planning by the government can prevent a market failure, through a decision to stimulate either private or public industry. It is interesting that although the first aircraft was flown in the United States, the period from 1903 to 1914 saw little aviation development in the United States, but great development in Europe. In 1914, only 23 of the 3,700 aircraft in the world were U.S. owned. Thus, at the outbreak of World War I, the French and the

British were prepared to make use of aircraft in a military role, while the U.S. was not. (15)

The French commitment to aircraft development has been consistent and in its planning, it has provided funding for both research and development and production. While the French government has had a history of fragmented responsibilities among agencies (unlike the Japanese MITI), in the face of the current economic situation a new Ministry of Research and Industry has been created. According to an aerospace manager, "It has the goal of coordinating modernization efforts among the research facilities, the production shops within industry, the managements of French companies and the government itself." (16) This new entity is to oversee an increase in French investment in R&D. Recognizing that they now devote only 1.8% of their GDP to R&D, and that the U.S., West Germany and Japan spend about 2.2%, the French plan to increase their spending to 2.5% by 1985. (17) This is overall R&D spending, as figures for aerospace alone are apparently not available. One indication of spending levels which will aid the aerospace industry is a decision to support the application of robotics to the aerospace automotive and electrical industries. The government's three-year Robotics Program will cost approximately \$360 million.

Another means of support for French aerospace is a guaranteed market from Air France. Air France has apparently not even considered options to the Airbus. For example, Air France ordered the Airbus A310 without considering Boeing's 767 and placed orders for 50 A320's (as announced at the June 1981 Paris Airshow), before that aircraft was even designed. (18) It is also interesting that while Air France initially wanted Pratt & Whitney engines for the A310, Snecma protested and in the event, GE CF6 engines were used (of

which Snecma produces about 27% in partnership with GE.)(19) The national airline is also flying the Concorde at a loss of \$67 million in 1981, and the decision has been made to cut back service to the United States to the Paris-New York route in order to cut back these losses, 70% of which are paid by the government.

Concerning the Concorde, it can be argued that despite its commercial failure, Concorde's development did maintain high French technical skills and prestige, as well as employment. Perhaps this is a more productive use of public funds, than unemployment checks. However, it can also be speculated that had the French put public development funds into the Caravelle XII, it could have been developed at a lower cost and in time to compete with Boeing's 727, the largest selling civil jet in the world. As it was, Aerospatiale used their own funds for the Caravelle XII and the plane came in too late.

French planning and government involvement has also led to concentration on economies of scale and production. In 1970, Nord Aviation, Sud Aviation and Sereb were merged to form Aerospatiale. In 1971, Dassault and Breguet merged. These moves were encouraged and supported by the government. The French follow a bi-polar model, which aims at having two firms in each industry segment, in order to provide a basic level of competition. Thus in aircraft, we see two engine manufacturers and two aircraft manufacturers.

Finally, aircraft and engine production are subsidized by the French government, basically in the form of loans which are usually interest free and which have extended pay back periods.(20) The following figures are indicative of the French commitment:

FRENCH GOVERNMENT FUNDING OF CIVIL AIRCRAFT CONSTRUCTION

(MILLIONS OF FRANCS)

	1980	1981	1982
CONCORDE	115	125	100
AIRBUS (A300,A310,A320)	623	605	826
ATR-42 COMMUTER	25	25	300
CFM56 ENGINES	318	452	655
HELICOPTERS	21	17	17
TOTALS	1,223	1,337	2,078

Source: DR. W. Stephen Piper, The United States Aircraft Manufacturing Industry: International Trade Aspects, Statement before the Subcommittee on Science, Technology, and Space Committee on Commerce, Science and Transportation, U.S. Senate, April 1, 1982, p. 14.

While these funds are provided with the understanding that they will be reimbursed (without interest), to the French government, of the 1,664 million francs paid to Aerospatiale before 1976 for A300 development, only about 12% had been repaid as of July 31, 1981. According to Congressional testimony by Dr. Stephen Piper of the office of the United States Trade Representative, there is no obligation to repay such funds by any specific date.

The availability of government funding is, of course, not unlimited, nor without cost. It is limited both by the relative size of the French economy and by its health. For example, French defense cuts have recently eliminated orders for 25 Dassault-Breguet Mirage 2000 fighters and delayed, by 12 to 15 months, a production start on Dassault's new generation Atlantic Maritime Patrol aircraft. (21) Recent articles in Aviation Week indicate that even the

nationalized firms will have to rely more on their own investment resources and on the international banks than they have in the past. If used, these sources will mitigate against future Concorde, as the banks will apply the test of commercial success. In the area of helicopter development, for example, France promoted its industry through military export orders, joint development programs, and development funding. Now that helicopter business is established, consideration is being given to fulfilling government requirements as a byproduct of viable commercial helicopter development. (22)

INDUSTRIAL POLICY ANALYSIS: THE U.S. CONTRAST

Before going on, it is useful to review the aircraft industry in the U.S., and the U.S. government's role, to provide some balance.

First, a key factor is that while exports are important, we have a huge domestic commercial and military market in the United States. Importantly, defense procurement accounts on the average for over 50% of aerospace sales in the U.S. (23) In addition, while the commercial production and export picture described earlier is negative, military export units showed an increase of one percent in 1981 over 1980, and in this time period, a 79% increase in value. (24)

Furthermore, contrary to a traditional private sector view, the U.S. government is heavily involved in the U.S. aircraft industry. In this regard, it is useful to quote Jacques S. Gansler, former Deputy Assistant Secretary of Defense for Materiel Acquisition.

"For reasons of historical military necessity, the government owns a large part of the aircraft industry - approximately one-third of the current plant space, a significant share of the manufacturing equipment, and all of the repair depots. In addition, the financial position

of the industry is very much dependent on the use of government financial resources (progress and advance payments, and loan guarantees such as those provided for Lockheed in the mid-1970s)." (25)

With regard to R&D, NASA currently spends about \$500 million per year on aerospace research which is of interest to our aircraft manufacturers. In terms of comparative data, in the past, U.S. R&D spending has dwarfed that of France, and the total EEC. For example, in 1966, out of a total of \$11.8 million of expenditures on aerospace R&D for the EEC (figures for Britain included) and the U.S., France spent 5% of the total, the total EEC share was 12% and the U.S. share was 88%. The pay-off was great. "Of the technological advances made in aviation since 1925, 70% were the result of military sponsorship, and an additional 18% were sponsored by civil agencies of the government." (26)

Without overstating the case for U.S. government involvement, it is useful to balance our perspective and realize that while there may be differences of magnitude and kind between U.S. and French government involvement, there are many similarities.

One final point of U.S. experience relates to the degree of consolidation of the U.S. aircraft industry. While consolidation has taken place in France, as noted above, it has also happened in the U.S. Taking the period from 1960 to 1976, the number of firms producing commercial transports dropped from five to three, while those producing helicopters dropped from nine to four, and those producing fighters went from nine to six. (27) Thus we see the same trend in a privately organized economy as we do in a planned economy.

INDUSTRIAL POLICY ANALYSIS: INTERNATIONAL COOPERATION

A discussion of the French aircraft industry, or for that matter of the American aircraft industry today, would be incomplete without emphasizing the degree of not only international competition but international cooperation and interdependence in the design and the manufacture of both military and civilian aircraft. As noted by Dr. Robert E. Marshall of the University of Massachusetts, "Since World War II, U.S. leaders in the conduct of foreign, as well as domestic, civil-industrial affairs, have been committed to a strategy of multinational interdependence." (28) For the U.S., this has become a sometimes uncomfortable reality, as we view the decline of our "smokestack" industries in the face of foreign competition. However, many American aircraft firms are fully engaged in cooperative projects with their foreign counterparts. As already noted, General Electric is cooperating with SNECMA on aircraft engine development. As another example, Fairchild Republic has a joint venture with SAAB of Sweden, on the Fairchild/SAAB 340 commuter aircraft. These arrangements appear to be motivated by the availability of large amounts of low cost capital overseas, as well as marketing advantages. U.S. antitrust constraints make it easier for G.E. to work with SNECMA on jet engine development, than to consider working with, for example, Pratt & Whitney. SNECMA, of course, has access to interest-free government loans. It is not clear, however, whether such a move by G.E. is in the American interest in the long run, since technology is being transferred to a French firm.

Returning to the case of France, one basic factor is that France, like other European nations, lacks the domestic military and civilian market of the United States, and must look toward cooperative development as a way of increasing market opportunity, and helping support development and production costs. Certainly, the formation of the EEC in 1958 has assisted in this regard. Realizing that since World War II, the U.S. aircraft industry has

been predominant, the Europeans have combined to maintain their aerospace industries and to effectively compete with the U.S.

In reviewing multinational cooperation, a great deal of insight comes from a Rand study by Mark A. Lorell, which was prepared in July 1980, under contract from the office of the Undersecretary of Defense for Research and Engineering. The Lorell analysis concludes that the Europeans have worked together to achieve three basic types of objectives:

- I. Maintain diversified and broadly based national R&D aerospace capabilities with restricted national budgets.
 - A. Reduce R&D costs for each participant to below the level of a national program.
 - B. Maintain or expand national employment levels and skills.
 - C. Acquire new technologies.
 - D. Encourage program stability.
- II. Advance regional political objectives.
 - A. Contribute to the formation of a Franco-German block.
 - B. Facilitate British entry into the Common Market.
 - C. Promote European solidarity.
- III. Counter U.S. aerospace competition.
 - A. Pool European industry for the development of aircraft to encourage European governments to buy European.
 - B. Combine European resources in development, production, and marketing to strengthen European sales worldwide. (29)

On the economic side, it is interesting that objectives such as reducing R&D costs, and total cost, have probably not been met. Lorell points out that each country resists R&D specialization because it conflicts with its goal of

having a total national capability. Work was more often distributed on the basis of each participant's expected unit buy and financial contribution, than on the grounds of comparative economic advantage.

The production of the Atlantic Maritime Patrol aircraft is an interesting case, because the U.S. was involved. U.S. participation was based on our effort to enhance our defense by standardizing NATO defense systems, and we agreed to support and buy a European aircraft. However, production of the Atlantic was marked by two different periods where multinational negotiations broke down over "who was to do what." In both cases, the French took the lead, put up their own development funds and went ahead. When the aircraft was completed, rather than becoming the NATO standard Maritime Patrol aircraft, only the French, Germans, Dutch and Italians bought it. The U.S., which had financed a large share of the development (as much as 1/3), bought the American P-3 Orion. The French succeeded in obtaining outside development funds in this case, but only after long negotiations and by using their own funds to keep the project alive. The French and the Germans, who were the major countries active in development, then saw the potential market reduced by U.S. competition and were unable to have the benefit of long production runs. And the U.S. certainly incurred increased costs by switching horses at the end. The case illustrates the difficulty and uncertainty of international cooperation and shows why development periods are likely to be lengthy.

In terms of the total costs of cooperative development, Lorell indicates that data are hard to find, but his conclusion is that, "Despite the difficulties in obtaining reliable and comparable data, the unit prices of the European aircraft appear to exceed those of their U.S. counterparts." (30) In addition to those cost penalties, Lorell finds that the inefficiencies and

compromises of collaboration lead frequently to significant schedule delays and penalties in aircraft performance. He finds that the relative success of the Airbus can be attributed to the following factors:

1. Few technological innovations meant little development and low risk.
2. U.S. components made up 45% of the unit price plus spares including most importantly the GE CF6 engine.
3. France dominated the project.
4. As a commercial project, price, reliability, performance and delivery had to be given strong weight. (31)

Yet there is considerable controversy over the real costs of the Airbus development and it is Boeing's contention that the A300 would have been cancelled if it had been a private program. (32)

The Lorell study brings important economic factors to light, even if they remain somewhat ambiguous, as described above. From a nationalistic perspective, it would seem that the U.S., with a large enough market to achieve economies of scale, ought to try to maximize the amount of development and production done within its own borders, rather than joint development or joint production. This would lower costs, save time, improve aircraft performance, keep more jobs at home, and avoid technology transfer. It also enhances the U.S. mobilization base.

Touching on the technology transfer point, this has several aspects. First, the U.S. may benefit by technology transfers from other countries and some "quid pro quo" may be necessary to maintain a flow. In addition, according to an AVIATION WEEK editorial in September, 1982, bright ideas get around in a hurry no matter what you do. The editor's observation is that the

only realistic policy option is to stay a year or two ahead in the hard-learned processes of technology. (33)

In any event, it appears that if investment capital is the key, the antitrust laws ought to be reviewed with the objective of more cooperation between U.S. firms. Apparently, there are recently created options which have not yet been tried by American firms. (34)

The Lorell study also confirms the importance of national political/defense objectives. If it is clear that the U.S. should act to maintain predominance in aerospace, it is also clear that allies who are strong in this field are stronger allies. Additionally, in an interdependent world which attempts to follow the dictates of comparative advantage, all countries benefit by the free flow of ideas and products. However, as we view the G.E./SNECMA CFM56 engine going both into the Airbus and 300 of the KC-135 tankers which Boeing is selling to the U.S. Air Force, distinguishing what is and is not in the national interest becomes more difficult. One fact, however, becomes clear. The national government concerned will not take a hands-off attitude. Both the U.S. and the French governments can be expected to act in accordance with their view of this national defense and economic interest, within the context of their differing economic and political systems.

INDUSTRIAL POLICY ANALYSIS: INTERNATIONAL TRADE

In the international civil aircraft marketplace, as indicated previously, the U.S. has had an overwhelming lead. In 1970, 90 percent of the world civil aircraft market belonged to the U.S. As the French and others have become more competitive, that share has fallen. Here, the basic concern of American

aircraft manufacturers seems to be one of keeping the international trade practices fair. American aircraft manufacturers such as Boeing have enough confidence in their product to compete aircraft versus aircraft. Fortune, in an October 1982 article indicates that Boeing is almost certainly the lowest cost producer of commercial aircraft in the world. (35) However they cannot fairly compete with the subsidized financing provided by some consortia or national governments.

In this area, the French government not only subsidizes development and production, but export sales as well. Furthermore, the French government, from President Mitterrand, on down, gets involved in promoting exports. While the U.S. government has in the past followed a somewhat laissez-faire approach to international aircraft trade, as we have watched first our trade balance and then our overall goods and services balance go into deficit, the Reagan administration has become more active. In international civil aviation policy for example, the U.S. government is taking a much less liberal position and is coordinating the counsel of the Department of Transportation, the Civil Aeronautics Board and the Department of State, in market by market assessments, followed by tougher bilateral bargaining. For example, during 1982 the U.S. signed a memorandum of consultations with the French, giving French air carriers certain trucking rights in the U.S. in exchange for increased flexibility for U.S. cargo carriers in Europe, and a series of similar agreements were signed with other countries.

In another case, the U.S. and Italy agreed to the establishment of a bilateral working group on aerospace matters. This followed a \$1 billion sale of McDonnell Douglas DC-9-80 aircraft to Alitalia. The French, who had been hoping that Alitalia would help launch the A320 instead, were very

disappointed by this development. (36) The deal, by the way, is based on support from the Export-Import Bank.

In addition, the U.S. has moved within the General Agreement on Tariffs and Trade (GATT) to achieve fair trade rules. As Dr. Stephen Piper of the U.S.I.R. pointed out in Congressional testimony, while greater enforcement is called for, the agreement on trade in civil aircraft has eliminated all customs duties previously imposed by the signatories on aircraft, engines, components and equipment. The French, as well as the rest of the EEC, are signatories. This is a complex area, but another aspect worth citing in light of the French practice is Article 6.2, which states that the pricing of civil aircraft should be based on a reasonable expectation of recoupment of all costs. (37) This is a critical point on which to have won agreement. Enforcement may be difficult and will have to be pursued actively. As a "bottom line", if a foreign government's subsidy is materially damaging to U.S. aircraft export or domestic business, such a case can be reviewed by the International Trade Commission (ITC) and appropriate action taken. This is a last resort, but action was taken recently by the U.S. steel manufacturers, who won their case against the Europeans.

As a final note, it is worth mentioning that aircraft price is not the only determinant in a sale. The results of an ITC study released in December 1982, indicates that passenger capacity and fuel efficiency are the most important considerations to U.S. domestic buyers. "The others in descending order, were quality, technology, price, technical and service support, fleet standardization, engine and availability." (38) However, price can be the deciding factor if aircraft are roughly equivalent and a foreign government is

willing and able to sell below cost. This appears to be the case in Eastern Airlines purchase of the Airbus.

In sum, the international marketplace is essential to the U.S. economy. It is a complex area and one where foreign governments are active participants in cooperation with their nationalized or their private firms. The U.S. government must continue to do better in its support of American aerospace firms, and American business must cooperate as well. There is really no choice since the foreign buyers of American aircraft are by and large the nationalized airlines of foreign countries. In most cases, these airlines are not going to make decisions on purely economic grounds. As the French pursue their best interest, so must the United States, with business and government in a cooperative and coordinated effort.

SUMMARY OF LESSONS LEARNED

Nationalization

Nationalization is not an appropriate step for the U.S. because:

- We do not have a comparable history of government/business cooperation.

Strong evidence of the advantages of nationalization would be necessary to even have such a step considered.

- I am not aware of any evidence that nationalized aerospace firms are more successful in developing commercially successful products, all other things being equal.

- Nationalization subjects industry to direct political action, which may or may not be beneficial. For example, the impact of Mitterand's social programs and the increased nationalization on French industry is not yet clear.

- If the government wants to stimulate industry, it may provide a financial stimulus to private firms just as easily as public firms. For example, government procurement, government sponsored research, and low interest Exim Bank loans are all used in this country to support our aerospace industry.

- Nationalized firms do not ignore commercial funding sources or commercial markets. Competing demands for government funds, the size of the national economy and political considerations all act to reduce funds availability. As we have seen in France, nationalized firms must look to their own earnings and to some commercial sources for funds. In addition, they compete for both commercial and military sales in other countries, in

order to achieve economic production runs and spread development and production costs. Thus, a product like the Concorde can be given development priority as a matter of national pride, but when it is not commercially successful, its flights are reduced and production is halted. From the U.S. perspective, a private firm utilizing commercial funds is more likely to produce a commercially successful product.

Government Industrial (Indicative) Planning

Formal government planning, even of the French "indicative" planning type is not recommended.

- The U.S. does not have France's historical experience with planning, does not have the bureaucratic expertise, nor the predilection for such government involvement.

- Because France's indicative planning has always involved private industry, it is hard to identify the government's formal planning role as a sine qua non. While it is clear that the process leads to a common view of the objectives, would large government financial incentives for aerospace research and for production have been just as successful in stimulating industry development, when linked with French defense contracts? This is not a meaningful question in that one cannot change history nor conduct controlled experiments in national economics. However, perhaps the essence of the matter is the consensus that is reached, rather than the process by which it is reached.

- Planning by its nature cannot be successfully restricted to one sector of the economy, such as aerospace. Competing demands for inputs such as labor, materials and funding would soon bring other industrial sectors into

the equation. The French work on the basis of an overall economic plan, projected five years, which takes a total look at industry. If, as we have seen, robotics is to be emphasized, they have a "road map" to look at to decide how much robotics funding and research will be directed to electronics, automobiles, or aerospace.

International Cooperation in Development and Production

The outcome of balancing advantages and disadvantages for this policy option are less clear to the writer than those listed above. On the one hand, there are a number of disadvantages.

- Our review shows that cooperative development and production probably lead to more expensive, lower quality aircraft, with longer lead times.

- There is a loss of technology. This may be less costly in the short run, when it is offset by risk sharing and other benefits. However, in the long run it can lead to a loss of competitiveness.

- There is a loss of employment opportunity to another country.

- From a mobilization perspective, there are fewer "hot" production lines and fewer skilled workers available in time of need, or available as a deterrent.

- It is naive to expect that any country will truly share in development or production in the long run, unless their position is very weak. In the long run, it is in each country's national defense interest to develop and maintain a fully integrated aerospace industry.

- Experience has shown that even in cooperative work, there must be a leader to ensure success. France has taken the lead role in most of the European cooperative efforts.

On the other hand, there are advantages in greater cooperation.

- Cooperation lowers the level of risk, by broadening the sources of funding.

-While there are technological transfers out, there are also technology transfers in.

- Cooperation can gain access to national markets which would otherwise be closed, as we have seen in the use of GE/Snecma engines by Air France.

-Cooperation with NATO allies, which produces standardized defense systems, enhances our national security.

- To the extent that cooperation strengthens the economy of allies, we benefit by stronger allies.

- In a truly interdependent international world, we all benefit by following the law of comparative advantage.

This summary indicates the need for good judgment in weighing the advantages and disadvantages, and essentially for careful decisions in each particular case. However, one matter which it clarifies for the writer, is that there ought to be an option for American firms to cooperate with each other to share risk. Hopefully, this option is developing through the relaxation of the antitrust laws which was noted in the report.

International Trade

As is the case for France, the U.S. aircraft industry and the economy as a whole, benefit from commercial and military export sales.

- These spread development and production costs.
- They help the balance of payments and create jobs in the U.S.
- The U.S. is learning however, that it is necessary to be a tough negotiator to ensure that fair trade practices, as set up under the GATT Agreement on Trade in Civil Aircraft, are followed.
- The Export Import Bank appears to be an effective tool to offset export promotion packages used by the French and others. It is hoped that the Congress will support the administration's recent initiatives to increase ExIm Bank capability.

Defense Procurement

As has been the case with France, defense procurement is a significant stimulus to the industry.

- There has been a positive carry-over from defense development to commercial development.
- Better defense planning and longer term contracts would maximize this benefit by reducing the peaks and valleys of defense production.

Government Sponsored Research and Development

The French have clearly realized the benefits of government sponsored R&D in this high risk industry and they are raising their levels of government R&D.

- Government research can assume large risks and avoid market failures.
- Government funding of research for civil aviation is preferable to government funding of civil production, in that it helps avoid costly mistakes like the Concorde.

Coordination, Cooperation and Consensus

The most valuable lesson to be learned from the French is that in an environment of limited resources and of international interdependence, the coordination of government efforts along with government/business cooperation, in pursuit of a consensus goal, is a most effective strategy for success. While the indicative planning process of the French does not seem to be an appropriate process or mechanism for the U.S., our business losses in international civil markets and in our own domestic civil aircraft markets carry the message that we have a problem. There clearly appears to be a need for a more responsible dialogue between industry, government and labor in this country, and for greater agreement on the long term goals of the aircraft industry in particular, and beyond that on the industrial future of the nation as a whole.

The best mechanism for accomplishing this is unclear but for the aerospace industry, perhaps this could revolve around a small but highly placed office in Washington, which would have a staff of less than ten persons. These individuals would coordinate government actions as well as act as an information clearing house, and as a focal point for meetings and

discussions between government agencies, the Congress, business and labor. In sum, it would be the catalytic agent for the formulation of a consensus on long term goals and for the cooperation and coordination needed to realize them.

FOOTNOTES

APPENDIX C (Pages C-1 to C-26)

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³Michael G. Landers, "France, Inc., Can the Economic Miracle Continue?", Industry Week, April 5, 1982, p. 40.

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⁷"Mitterrand Rejects Isolation to Solve Fiscal Woes," The Dallas Morning News, March 24, 1983, sec. A, p. 24.

⁸The Hudson Institute, France And Its Future, 1973-1985, Croton-on-Hudson, New York, 1973, p. 73.

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¹⁴It is interesting to note that although Jacques Mitterrand is one of Francois Mitterrand's brothers, their success has been earned independently. Jacques Mitterrand has been President of Aerospatiale since 1975 and before that was a highly successful Air Force officer, holding such positions as Deputy Chief of the General Staff, 1968-1970 and Commander of the Strategic Air Force, 1970-1972.

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Japanese Policy

I. Historical Perspective

The Japanese economy has not only come of age, but it is taking giant steps into a new one, the third industrial revolution, borne of technology. Building on the success in established industries like automobiles, consumer electronics and steel, Japan is targeting the industries of the future: computers, aerospace, materials, biotechnology, robotics and fiberoptics. (1) The challenge to American leadership in these fields that are the cutting edge of technology is impressive.

Japan is a small island nation, virtually devoid of natural resources. It has traditionally relied on the sea for its sustenance. It has retained remarkable racial purity and unique social customs despite vast increases in international travel and association. In order to build modern commerce it has had to marshall the only major assets it possesses: the intelligence, industriousness and enterprising nature of its people. Today, at a time when technology and capital know no borders, these are the very ingredients for success.

Historically, the Japanese government involvement in industrial development began with the Meiji Revolution in 1868. The revolutionary government attracted highly educated and motivated individuals, eager to push their ideas for both industrial and military development. Four short years after the revolution, this ambitious cadre had brought about Japan's first steam-powered locomotive and the lighting of homes with kerosene lanterns. (2)

During the early 1900's this cooperation between government and industry began to wane. Industry prospered as a result of the wealth accumulated

during the Sino-Japanese War, the Russo-Japanese War, and World War I. The private sector attracted energetic and talented people. However, during the 1920's and 30's a series of trade disputes lead to the disintegration of the world economy and the Great Depression. Japan was cut off from its supply of natural resources and crude oil. (3) This scarcity strengthened the coordination of industrial and government activities by instituting a centrally planned and regulated economy in order to allocate resources and assign priorities. After World War II, the need for the reconstruction of industry and the restarting of international commerce only increased the cooperation between government and business. As a result, Japan's industrial strategy of the 1950's depended heavily on establishing trade intensive industries starting with simple, low-skilled products and moving towards more sophisticated products after an initial industrial base was established. As a "have not" nation, it had no other choice in order to build an economy and raise its standard of living.

Japan's success has been great indeed. Since 1960, Japan's productivity growth rate in manufacturing has exceeded that of the United States by an average of 5.5 percent. At current rates, it will surpass American worker productivity by 1988. Last year Japan produced more automobiles, more trucks, more televisions, more ships and more robots than American companies. (4)

Much has been written about the reasons for this incredible achievement. Certainly culture, and geography have played a part. However, the cooperation between industry and government borne of revolutionary zeal and economic necessity, has had the starring role in this achievement by creating the environment for success. Today, this cooperation is embodied in the Ministry of International Trade and Industry (MITI), which was created to foster trade

growth through industrial development. Other industry groups unrelated to trade - for example, those associated with the ministries handling finance, agriculture, construction, transportation and education - do not receive direct MITI attention. (5)

II. MITI Policy

The activity of MITI is perhaps best summed up by Ira Magaziner and Robert Reich in their book Minding America's Business:

"Perhaps the most significant aspects of Japanese industrial policy is the way in which MITI is able to find the right competitive levers to assist the development of specific industries at specific times and to vary these as competitive economics of businesses evolve. This makes policy both efficient and effective." (6)

These levers consist of persuasion and subtle and not-so-subtle measures such as research subsidies, development financing, defense purchases, cartel formation, targeted tax relief, export insurance and financing subsidies, and import protection for "infant" industries. MITI has sponsored joint ventures and encouraged mergers where economies of scale were necessary for international competitiveness. Industry associations were created to channel research and exchange information.

Recently, MITI has encouraged the wholesale movement of high energy-consuming industries and low added value sectors to less developed nations. Its goal is to move the workforce into the production of high added value products to support a higher standard of living. Aircraft and engine manufacturing are two such products. (7)

By shedding its less desirable industries, Japan also made a profit and positioned itself for future high added value business. This was accomplished

by encouraging the sale of "turned key" plants to countries such as Korea, Taiwan and Brazil. (8) While profitable in themselves, such sales enabled Japan to fill the plants with Japanese machine tools, creating a ready market for replacement parts and spares. Machine tool manufacturing is also a high added value business.

Having moved Japanese industries to the forefront of technology, MITI has gradually changed its tactics. Protectionist measures have been reduced in favor of stimulating research and the commercialization of its results. A cartel was formed to lease robots to industry at favorable rates. Cooperative research associations among companies were encouraged by allowing full tax credit for member contributions. Over 25 have been created. (9) Tax revenues from various sport races finance research controlled by MITI in an off-budget line item. (10) More importantly, capital export is strictly controlled, leading to low interest rates and attractive opportunities for financing new products. Loans are channelled through the Japan Development Bank, the Bank of Japan and the Japanese Export-Import Bank.

Despite the view that MITI is Japan, Incorporated, it is not monolithic. The Ministry gets basic guidance for industrial policy from special advisory groups, which are composed of technical experts, industry and financial representatives, and even members of the media and consumer groups. Furthermore, MITI does not act alone in determining policy and does not directly finance its own programs. Attempts to restructure industry are limited by the Japanese equivalent of the Fair Trade Commission. The Japanese parliament (Diet) and the prime minister's office exercise normal political control, and the Ministry of Finance must approve its budget. MITI is composed of approximately 2500 civil servants who are drawn from the

universities, and other prestigious institutions as well as retired Diet members. (11) Industry "desks", similar to Department of State "desks" for foreign countries, monitor individual sectors and host meetings. This is hardly a huge bureaucracy.

MITI's basic guidelines in promoting Japan's aerospace industry are: (1) promoting free trade for all aerospace products (i.e. no tariffs or quotas); (2) seeking international cooperation for a percentage of major development projects; and (3) government funding of the research and development for new aircraft and engines. (12) MITI has stressed that while the Japanese government should bear the entire risk in development of new aircraft technology, the ultimate business risk of product success should be borne by industry. The initial priority for Japanese industry is to seek participation in international joint development projects, having achieved a minimum base through licensed production and subcontracting.

III. Japan's Aviation Prospects

The Japanese aircraft industry surprised the world by developing the famous Zero fighter just before the outbreak of World War II. However, the American occupation after the war circumscribed all aviation activities after Japan was defeated in the War. It was seven years later that the Japanese aircraft industry was allowed to resume its activities, and in 1954 aircraft production was begun on a small scale. A steady progression of government-orchestrated projects followed, starting with turboprop airliners and culminating with original fighter designs.

A brief list of Japanese manufacturing companies and their efforts over the years is illuminating: (13)

Nikon Airplane Manufacturing Co.	YS-11 turboprop airliner (1958)
Fuji Heavy Industries (FHI)	FA-200 light aircraft (1967)
	204/205 Bell helicopters (licensed)
Mitsubishi Heavy Industries (MHI)	MU-2 turboprop (1963)
	MU-300 Diamond business jet (1980)
	T-2/F-1 trainer, fighter
	F-4 fighter bomber (licensed)
	F-15 fighter (airframe) (licensed)
Kawasaki Heavy Industries (KHI)	P-3C airframe (licensed)
	C-1 cargo transport
	VK-107 helicopter (licensed)
	BK-117 helicopter (joint venture w/MBB Germany)
	500D (Hughes) helicopter (licensed)
Ishikawajima-Harima Ind. (IHI)	F-100 engine (co-production)
Civil Transport Development Corp. (MHI, FHI and KHI, 1973)	Boeing 767 parts (17% of fuselage)
	YXX studies (150 pax a/c)
Japanese Aero Engine Company (MHI < FHI < IHI)	RJ-500 with Pratt & Whitney and Rolls Royce (150 pax a/c)

The following are examples of government direct financial aid to establish this effect. It is not meant to be inclusive: (14)

- National Aerospace Laboratory (continuing support)
- Research Coordination Bureau (continuing support)
- National Research Institute for Materials: \$314 million in 1981
- Boeing 767: \$9.9 million in 1981 for development
- F-15: \$1.8 billion procurement premium

- RJ-500: \$22.8 million in 1981 for development
- YXX: \$6.3 million in 1981 for design studies and market analysis for new 150 passenger airliner

In 1981, total Japanese sales of planes, parts and engines reached 275 billion yen, or about \$1.25 billion at current exchange rates. Of that total, 85 percent were contracts with Japan's defense agency. But, aided by strong government support, Japan's aerospace industry hopes to triple total sales and increase civilian production tenfold in the next decade, while gaining valuable technology through participation in a number of major international projects.

A key milestone for Japanese aircraft industry will be the next large commercial airliner, probably in the 150 passenger class. This market is currently being filled with old Boeing 727's and the Douglas DC9-30, over 2000 aircraft. Japan has obtained partnerships in both the airframe and engine developments. The stated MITI goal is to achieve 15% of the aircraft world market on a value basis by the year 2010. (15)

IV. Labor Practices in Aerospace Industries

Most of the Japanese aerospace companies are huge and tend to follow benevolent, institutional policies for their employees. The result is workforce stability which contributes to growth and productivity. Employees can be assured of lifetime employment with the company. Employees receive modest salaries, but are paid incentive bonuses twice a year, amounting to 25% of basic pay. Promotions depend upon experience and capability; and, in traditional oriental cultures, age. This emphasis on seniority may be a drawback for fresh ideas and innovation, but evidence is lacking, judging by

the success achieved in consumer electronics and automobiles. After approximately 10 years, a worker can receive a low-interest loan to buy a house, an enormous incentive in under-housed Japan for attracting and keeping quality employees. (16)

Most Japanese engineers work for the same company their entire career. For instance, at Mitsubishi, university graduates initially receive low salaries, but loyalty is rewarded through attractive fringe benefits. It appears that conscious efforts are made to match the engineer to a job of his choice, and assure him that he will not be threatened with layoff. The impact on employee morale and productivity with this institutional approach is remarkable. Both blue and white collar employees normally work an average of 5 hours overtime per week. Paid vacations amount to 20 days annually. Fringe benefits total approximately 20% of an employee's salary. (17)

V. Conclusion

The Japanese have a unique heritage that has enabled them to meet the challenges of the growing international marketplace and prosper. Part of this heritage is geographical and cultural, but part is tied to the successful cooperation between industry and government. That cooperation is bearing fruit in their aerospace industry. Experience is being gained through foreign-licensed manufacturing and low technology aircraft programs such as turboprops and business jets. Clearly, Japan is planning to build part of their economic development and security for the coming decades on aircraft technology. Their biggest asset is their people and that constitutes quite a challenge for the rest of the world. The danger for America is that Japan has not been content to obtain just a market share in those industries that it targets; they achieve market domination.

FOOTNOTES

- (1) Industry Week, "Japan's Economic 'Grand Design'", September 20, 1982, p. 50.
- (2) Diane Tasca, "U.S.-Japanese Economic Relations, Cooperation, Competition and Confrontation, (Pergamon Press 1980), p. 89.
- (3) Ibid., p. 90.
- (4) Alton D. Slay, "The Air Force Systems Command Statement on Defense Industrial Base Issues", (Air Force Systems Command, 1980), p. IV-3.
- (5) Tasca, "U.S.-Japanese Economic Relations", p. 90.
- (6) Ira C. Magaziner and Robert B. Reich, Minding America's Business, (Harcourt Brace Jovanovich, 1982), p. 295.
- (7) "Hi-Fi or Hi-Tech?", Flight International Magazine, November 20, 1982, p. 1521.
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- (10) Ibid., p. 292.
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- (13) Office of Science and Technology Policy, "Aeronautical Research and Technology Policy", November 1982, Vol. II, pp. II-43,44.
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THE AIRBUS: A CASE STUDY

Although the purpose of this research paper is to look at the aircraft industry in a broad sense, it may be beneficial to look at a specific example, such as the airbus, to illustrate the competition the U. S. industry faces.

Airbus Industrie is a consortium of major European countries, under the leadership of France. It was formed by the governments of France and Germany, which were later joined by the United Kingdom and Spain as partners, and the Netherlands and Belgium as associates. Although the mix of government vs. private ownership varies within individual countries, the consortium itself is approximately 70% government owned.

Their first major product was the A300 Airbus which was the first wide-body airliner powered by only two engines. By offering wide-body comfort with lower operating costs the aircraft, born a decade ago, has grabbed a fifth of the world commercial aircraft market. Nearly 190 A300's are now in service with some 30 airlines. Since the beginning of 1981, a tough period for the industry, 65 Airbusses accounted for over half the total of 117 announced orders for wide-body aircraft(1). When compared to non-U.S. markets Airbus' gains are even more dramatic (Figure 1). This is especially significant since 60% of industry sales over the next 10 years are projected to be to non-U.S. airlines.

On the horizon is the new A310, a smaller version of the A300. It will seat around 225 passengers vs. 250 plus for the A300 and is designed for optimum performance on short and medium routes. Of significance is that it completes head-on with Boeing's new 757 and 767 aircraft. The first of 102 A310's ordered so far by 17 airlines should be in service in the Spring of

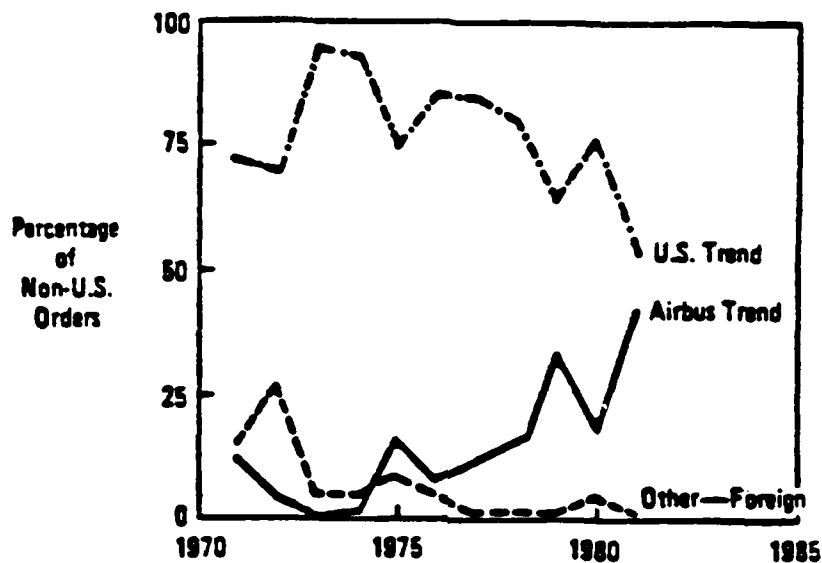


Figure 1.

1983. Airbus also plans to produce a 150-seat airliner, the A320, and is studying the possibility of developing three other aircraft. These include a stretched A300 and two long-range models. It is obvious from the above that Airbus intends to make its mark in the world aircraft market. By 1990 they plan to produce a full Boeing-style family of airliners to compete with most U.S. products (Figure 2). Even in today's adverse economic climate, there appears to be only a small slow down in their march toward that goal.

Why has Airbus been so successful when historically, the Europeans have not been able to develop an economically feasible airliner? In fact, the nine programs preceding the Airbus were economic failures(2). For one thing, European governments have decided that their aerospace industries will not take the backseat any longer. They recognize the importance of the aerospace

Airbus Competition

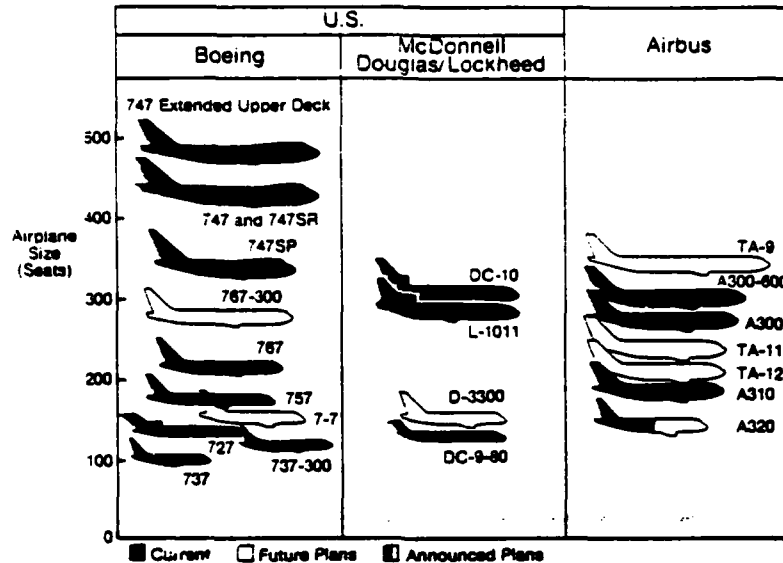


Figure 2.

industry in furthering their social and philosophical values. This makes Airbus' goals national policy and allows their countries to view the effort as a national investment. Airbus Chief Executive Officer B. Lathiere rejects allegations that the company is not run along commercial lines. But Airbus Industrie makes neither profit nor loss. All risk is borne by the partner companies and to varying degrees by their countries. Therefore, competition for U.S. companies has become a government-backed corporation with tax-supported capital and political support.

This is how Mr. K. G. Harr, Jr., President of the Aerospace Industries Association of America described government marketing support for Airbus during his testimony before the House Committee on Foreign Affairs (Subcommittee on Economic Policy and Trade) on February 23, 1981:

"These initial (Airbus Industrie A300) sales were almost certainly directed procurements to 'buy national.' French Finance Minister, Jean-Pierre Fourcade put such pressure on Air France in January 1975. Other sales

resulting from government pressure included Lufthansa, Iberia, and more recently Sabena. Once established in a fleet, there is no further need for such pressure: a carrier has an economic incentive to buy additional units (and derivative models) because of the previous investment in spares, training, specialized ground support equipment, crew familiarity, etc.

"'Political leverage' is another important factor in the sale of European-produced aircraft. Although difficult to prove conclusively in any legal sense, events have provided evidence that there has been a continuing involvement by governments of Airbus participants to induce aircraft sales by associating sales to political agreements such as: (1) trade agreements, (2) route awards/landing rights/frequency rule adjustments (3) military weapons support, and (4) economic/regional assistance. A recent twist to the 'political leverage' was Australia using Trans Australia Airlines' (TAA) purchase of A300's as leverage on the EEC to buy more Australian mutton."

In addition to these buy national pressures and political influences, large amounts of manufacturing subsidies have been provided Airbus by its European governments. The actual amounts are difficult to estimate because of the multitude of countries involved and the lack of firm data. However, an estimate can be made by comparing the A300 program with a typical U. S. program of equivalent size. Boeing did this in a May 1982 pamphlet entitled, "International Competition in the Production and Marketing of Commercial Aircraft". The study compared the A300 program with U. S. large aircraft programs and concludes that Airbus has probably been subsidized in excess of \$5 billion to date. When divided over the 700 airplanes projected for Airbus programs, that equals a per-airplane subsidy of \$7 million or 20% of airplane price. Boeing's conclusions also suggest no feasible prospect of breakeven for the Airbus programs. In fact, their comparison of the A300 program with Lockheed's L1011 indicates that the A300 program would have been abandoned some time ago under U. S. private industry economic criteria. The L1011

The A300 Would Have Been Cancelled as a Private Program

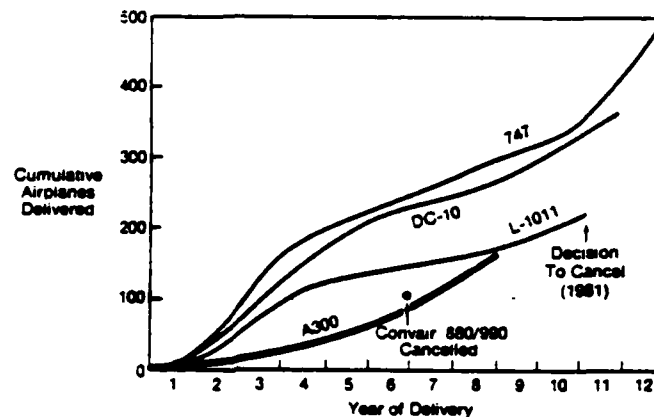


Figure 3.

which was consistently ahead of the A300 in aircraft deliveries was cancelled due to economic losses resulting from insufficient volume (Figure 3).

A final area of subsidization is financing. Since state-of-the-art technology is generally known to all aircraft manufacturers at any given time, and attempts to use unproven technology is too risky, there tends to be relatively few technical differences between competing commercial aircraft. The main differences appear to be in engines and they are available to everyone. This doesn't mean the U.S. cannot build technically superior aircraft -- they can and do. However, in the case of the Airbus, performance is close enough that financing becomes a major pricing factor. Financing typically represents 9% to 10% of program life cycle costs and as figures 4 and 5 indicate interest rate subsidies can significantly offset performance or

Interest Rate Subsidies Can Offset Pricing Advantages

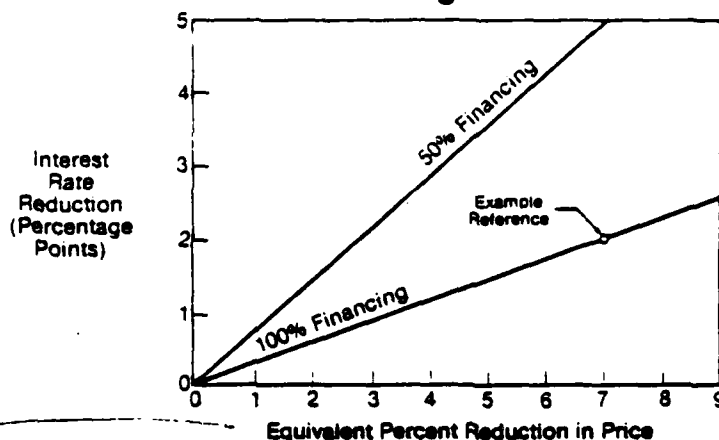


Figure 4.

pricing advantages (3).

Official export financing is governed by international agreements which set minimum rates and maximum terms that should theoretically provide financing parity between competing international manufacturers. In the case of the Europeans and the Airbus, they consistently offer the most advantageous financing terms allowed. The Export-Import Bank in this country does not. In fact, the Eximbank's policies regarding loan fees, model limitations, and exclusion of developed countries from loan eligibility make U.S. producers less price competitive.

The extent of Airbus financing subsidies is reflected in this statement by Frank Borman, Chairman of Eastern Airlines, after that airline's purchase of Airbus aircraft (4):

"If you don't kiss the French flag every time you see it," Borman recently told an employee gathering, "at least

Interest Rate Subsidies Can Offset Fuel Efficiency

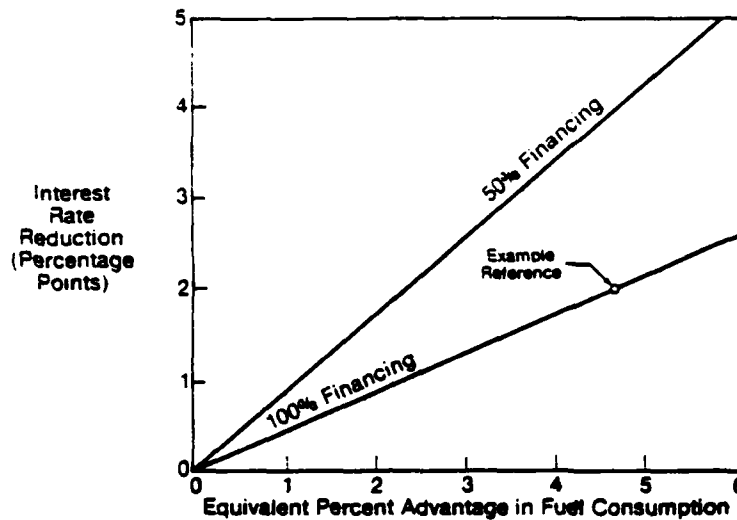


Figure 5.

salute it. The export financing on our Airbus deal subsidized this airline by \$100 million."

The terms offered Eastern were truly exceptional. First, Eastern was given four aircraft to operate on a nearly cost-free trial basis. Then when Eastern confirmed its order, the trial lease agreement was converted to a 14.5 year lease agreement. Airbus also agreed to arrange export financing for \$250 million for 10 years at 8.25 percent interest and provided approximately \$96 million of manufacturer's subordinate financing. They further agreed to underwrite the operating costs of a portion of the capacity of the aircraft through a "Deferred Seat Plan" (Eastern said it needed only 170 seats while the A300 had 244). The plan allowed for 12 of the 23 airplanes to be paid for as if they had only 170 seats for up to 4 years or until load factors exceed a certain level. Additional inducements were offered as well (5). Obviously, it would have been impossible for a private U.S. aircraft manufacturer to come close to meeting such terms.

The above has shown Airbus Industries to be a major competitor to U.S. aircraft manufacturers and demonstrates the large inroads Airbus has made in the world commercial aircraft market. The consequences of further gains could seriously impact the U.S. aircraft industrial base and the U.S.'s ability to maintain their technological superiority in this area. We have already seen Lockheed discontinue production of the L1011 and McDonald Douglas' DC-10 would have been next except for the sale of 40 KC-10s to the U.S. Air Force. It is due to events such as the Airbus success that this research paper was undertaken. Whereas in the past, the U.S. has dominated the world commercial aircraft market, the Europeans, with their Airbus, have now challenged that domination.

In closing, it's only fair to mention recent problems Airbus Industries has encountered. *LeMonde*, the French newspaper, in its January 28, 1983 edition reported on a letter sent by the Chairman of Aerospatiale to the French Transport Minister. The letter cited the problems of unsold aircraft and a lack of financing support for Airbus sales by the British and Germans. As evidence of the lag in sales, the Chairman stated that for the first time in Airbus' 12 year history, firm orders for the A300 were two aircraft lower at the end of 1982 versus 1981(6).

While this pause in Airbus' success story is worth noting, it's important to recognize that the problem may only reflect the poor world economic conditions. In fact, the U.S. manufacturers are having similar problems. Airbus Industries has demonstrated over many years their resolve and competitiveness. As the world economic conditions improve they will continue with their goal of taking a greater share of the world aircraft market from U.S. manufacturers.

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FOOTNOTES

APPENDIX E (Pages E-1 to E-9)

¹Robert Ball, "Airbus is Rough Competition," Fortune, October 18, 1982, p. 121.

²Stephen Piper The U.S. Aircraft Manufacturing Industry: International Trade Aspects, Statement before the Subcommittee on Science, Technology, and Space, Committee on Commerce, Science, and Transportation, U.S. Senate, April 1, 1982, p. 10.

³John E. Steiner, Technical and Financial Imperatives, What's Ahead, Annual Meeting of Panel on New Directions in Commercial Aerospace, American Institute of Aeronautics & Astronautics, Baltimore, MD, May 26, 1982, p. 6 and 7.

⁴Business Week, January 11, 1982.

⁵The Aerospace Research Center, The Challenge of Foreign Competition to the U.S. Jet Transport Manufacturing Industry, December 1981, p. 73.

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APPENDIX F: TWO STAFF STUDIES: Multi-source Production
Government Aircraft Depots

MULTI-SOURCE PRODUCTION

Citizens of the U.S. have historically championed the free market and extolled the virtues of economy and quality which result from open competition. "Build a better mousetrap and the world will beat a path to your doorstep" goes the old saying. In the U.S. defense industry our nation has drifted away from the precepts of competition and the sole source contract has become the predominate way of doing business. Somehow, despite the intent of procurement directives to the contrary, sole source business accounts for about sixty per cent of the total dollars spent of defense.

The following table illustrates the extent to which competition occurs in defense contracts:¹

<u>Type Contract</u> (As a % of total dollar awards)	<u>Fiscal Year</u>	
	<u>1980</u>	<u>1981</u>
Competitive	36.0	40.7
Non-Competitive	64.0	59.3
(As a % of total award actions)		
Competitive	39.7	48.1
Non-Competitive	60.3	51.9

Government agencies, however, continue to extoll the virtues of competition. The results of the Joint Department of Defense (DOD)/Office of Federal Procurement Policy (OFPP) Competition Workshop, which was held in May 1981 listed

the following conclusions which have been condensed by the author:²

1. When properly used, competition is the best stimulus to arrest cost growth, generate optimal prices, and stimulate technological innovation. Where marketplace forces or factors of production do not inherently support competition, the Government must act to secure the advantages of competition.

2. Competition must be promoted but not mandated in an arbitrary manner. We should not assign quotas or goals in the form of percentages or absolute dollars to the achievement of competition. Goals, such as for small business awards or equal employment opportunity accomplishments, are not useful in dealing with competition for Government contracts.

3. Competition is a highly complex force. To assure its sustenance and provide maximum benefits, continued research and operational experimentation must be applied throughout the Government procurement community. The competition employed now and in the future will be substantially different from the competition used yesterday.

One of the reasons given for sole source contracting is that in many cases only one company has the capability to develop and produce the desired piece of equipment. Another more insidious reason is the procedure of allowing the same company that wins the design and development contract become the sole producer of the item. This procedure results in an "all or nothing" contest. Since only a few large defense programs are started every five or ten years, the competition is vicious and limited to only a few large firms that have the resources and time to compete.

Awarding the production contract to the same company that wins the design and development encourages companies to come in with unrealistically low bids for the design with hopes for making up losses during production when

there will be no competition. When he was Deputy Secretary of Defense, Frank Carlucci acknowledged this practice of "buying in" when he stated:³

"A persuasive case has been advanced that the early phases of development of a new weapon system must be adequately funded. I support this in principle; however, industry has a major responsibility to identify accurately and fully the costs of its proposals. Industry must not commit itself to artificially low costs during the competitive bidding process and subsequently then blame DOD for inadequately funding the program. Nor should industry attempt to "buy in" to the program"

A practical way to increase competition on defense programs would be to always establish at least two sources for production on all large quantity programs. This would require a second competition for production on each weapons system. With this process, the competitors for design and development would be forced to make realistic cost proposals since there would be no assurance of recouping losses during production.

Limited existing data shows that cost savings between 10-40 percent would result during the production phase. Normally the designer of the subject weapon system should be one of the two production companies. In fact, this could be a provision in the contract as long as one other firm was allowed to join in the production phase.

Because of the limited number of units produced in current weapons programs (only 100 B-1B bombers) and the large cost for production equipment; practically speaking, only two companies could be expected to enter production on most contracts. Hence, the terms dual sourcing and

second sourcing have gained wide usage whenever competition during the production phase is discussed.

It has been demonstrated that two competing production companies can be used effectively even on low volume, high cost items. The production performance of Todd Shipyards and Bath Iron Works on the Navy's PFG-7 class guided missile frigate has produced the first on budget, on time ship purchased by the Navy in recent memory. And yet the total number of ships built will only be forty-six.

The largest amount of data on the results of multi-source production comes from the World War II aircraft industry. It was shown that the learning curve for competitive production sources was $4.4\% \pm 2.1\%$ steeper than than sole source curves.⁴ Boeing, Douglas and Lockheed each produced B-17s. Convair, North American, Ford and Douglas produced B-24s. Boeing at Wichita and Renton as well as Martin and Bell built B-29s. In each case, competition encouraged multiple source competitors to come up to efficient production faster than in sole source aircraft programs.⁵

Reliability also seems to result from second source contracts. Examination of a Mean Time Between Failure (MTBF) chart of the AIM-7 Sparrow missile shows a decrease in reliability in late 1974 until mid 1975 when a second source was introduced. Reliability improved with the addition of a competing source and in 1979 reliability of items from the prime contractor began to exceed those of the second source by nearly 100 hours MTBF at the 80% confidence level.

The key to multi-source contracts is some measurement of contractor performance which is then used in subsequent years to award a percentage of the production. In the case of a dual source production, the split might be sixty and forty percent with the largest share going to the contractor who maintained the required reliability with the lowest unit cost. In this manner, each year the sources would recompute for the major share of next years production.

In the case of the Sparrow missile, after General Dynamics entered production as the second source, unit costs dropped seven percent. Raytheon, the prime contractor, subsequently dropped its unit cost eight percent. Similiar shifts in unit cost curves occured after second sourcing Bullpup, Sidewinder and Tow missiles.⁶

The recent cost growth trends of major defense weapons systems are cause for alarm. GAO in 1979 stated that their review of programs since 1969 "failed to find one example of where the Department of Defense accurately estimated or overestimated the cost of any major weapon system." Total program cost growth during production for the period Dec 75 - Jun 81 of typical systems under sole source production was as follows:⁷

<u>Program</u>	<u>Cost Growth</u> (%)
UH-60 (Black Hawk)	22.5
M-198	-16.0
F-16	22.4
E-3A	5.3
CAPTOR	38.0
HARPOON	25.2
TRIDENT	5.8
PHM	-1.3
Average	12.7

During the same period, competitive production on the following systems produced an average growth rate three percent less than the average non-competitive rate.⁸

<u>Program</u>	<u>Cost Growth</u> (%)
Sidewinder AIM-9L	19.0
Sparrow AIM-7F	9.4
SSN-688	-3.6
FPG-7	13.8
Average	9.65

There are many reasons for multi-source contracting. The main reasons which have been illustrated above are to reduce costs and improve performance. Mr. Harvey Gordon has compiled a more complete list which includes the following:⁹

- Broadening the production base
- Evening out the fluctuation in defense industry which leads to feast or famine situations for individual firms.
- Achieving superior equipment through increased competition
- Facilitating NATO participation as coproducers or through coproduction as subcontractors
- Facilitating the attainment of socio-economic goals by increased award to minority and small business contractors and or subcontractors.
- Preserving competition for the sake of competition per se.

To the above list I can add only one additional reason for multi-source contracting in the production phase:
We can no longer afford not to.

GOVERNMENT AIRCRAFT DEPOTS

The Defense Department, using a three-level maintenance system, operates aviation depot maintenance facilities. Military aircraft maintenance has been divided into three levels:

1. Organizational level maintenance consists of daily actions performed at the squadron level. Often at this level the maintenance consists of identifying a faulty piece of equipment and replacing it.
2. Intermediate level maintenance is the next higher level of maintenance. Faulty equipment is tested and components are repaired. Routine items such as engine overhauls and repair of hydraulics and electronics are accomplished.
3. Depot level maintenance is the highest level of maintenance and often consists of complete disassembly of aircraft and components and manufacturing replacement parts. Depots also specialize in crash damage repair and airframe modifications.

One suggested action for improving the overall aircraft industry and reducing costs in the Defense Department is to turn over the operation of aviation depot level maintenance facilities to the private sector. Predicted benefits to the Defense Department would occur because of more efficient plant operations by private industry. Predicted benefits to the aircraft industry would occur because of a more continuous demand on the industry which would offset the more cyclic nature of military production contracts. This approach compliments proposed actions to integrate military and commercial business. It is envisioned that overall U.S. industrial productivity would go up, since

the large government investments in plant and equipment could be utilized by the private sector.

The twelve major Army, Navy and Air Force aviation maintenance depots have 3.6 billion dollars in assets and employ a workforce of 60,000. These facilities account for \$2.8 billion in aviation maintenance each year. If they were a corporation, they would rank one hundred fortieth in the Fortune 500.¹⁰

In accordance with the latest directives, private enterprise is given the opportunity to bid on military aviation repair tasks. The depots through their service logistics commands also bid for the repair tasks. For purposes of bidding, depots must compute in their bids all facility and personnel costs including military salaries. These items, of course, do not appear in final depot product costs. If it is determined that depots can perform maintenance more economically than private business, a second round of bidding among depots is conducted to determine which will receive the job.

The goal for depots is to break even in their transactions but this does not completely describe the operation. Profits from depot production can be used to improve facilities, equipment and work conditions and thus reduce the net profit to zero. The most profitable depots can be expected to have the best furnished offices and the best outfitted work spaces. Under certain conditions profits from one year can be carried over to offset expected expenses.

When bidding for a job, depots estimate the number of manhours and amount of material required for a job which is then fixed in a contract with the service logistic command. As a matter of practice, depots do not bid for

civilian work except for unique components which are not manufactured in the civilian sector. As an example, a Navy depot repairs skis for the snow capable Lockheed C-130. Depots do engage in foreign military work also. At the beginning of the Falklands Crisis, some depots were in the awkward position of doing repair work for both Britain and Argentina.

The incentives which cause government operated depots to strive for more efficient operations are three:

1. There is an ever present fear that Congress will close another depot which has happened in the past. Workers believe that if a depot is going to be closed, it will not happen to the most efficient and productive installation.

2. The carpets, drapes, office and shop supplies are purchased from depot profits. The more efficient the depot, the better the facilities.

3. The performance evaluations of the military officers and the merit pay of civilian managers operating the depots are based in part on the overall efficiency of the depot.

Whether or not private industry could run the depots more efficiently is open to debate. There are, however, some facts which can be grouped into advantages and disadvantages. The disadvantages of government operations are as follows:

1. The government depot workforce is more expensive than a comparable privately run workforce. Government wage scales and depot unions ensure that wages are comparable with area averages which may include a distant city when the depot is in a remote rural area.

2. Flexibility of the workforce size is more restricted under government operations. Because of congressional imposed hiring ceilings, it is more difficult to expand the workforce. Unions make it difficult to reduce the workforce.

The advantages of government-operated depots are:

1. Better control. The government can direct the immediate repair of critical items on short notice. A new contract does not need to be negotiated every time there is a radical change in the workload as would be required with a private contractor.

2. Better response. If the need arises, the government can direct depot repair of an aircraft component before funds are identified. Contracts with a private firm cannot be made unless money is identified for the task.

3. Government-operated depots represent a large mobilization asset in their excess plant capacity. It is doubtful that any private business would be willing to bear the large overhead costs associated with maintaining this excess plant capacity.

Instead of all private or all government-operated depots, some combination may be a more efficient solution. But on examination, one finds that this is indeed the situation today. A sizeable portion of military aircraft rework is contracted to private enterprise. The fact that many small private aircraft repair facilities are not part of a large commercial aircraft plant is testimony to the fact that economics dictate otherwise. It is recommended that the military aircraft maintenance depots continue to operate as they now do, providing a benchmark against which private industry can compete. More important, the military depots provide DOD with a flexibility and response that would be difficult to match in private industry.

FOOTNOTES

APPENDIX F (Pages F-1 to F-10)

¹Blair A. Peterson, "Why Government Widgets Cost More," Research Paper, 20 May 1982, p. 40.

²Ibid., p. 39.

³Frank C. Carlucci, "We Must Do It," Air Force Logistics, Winter 1982, p. 110.

⁴Jacques S. Gansler, "Dual Sourcing, Competition During a Program vs. Competition For a Program," Unpublished Study by TASC, January 1983.

⁵Ibid.

⁶Ibid.

⁷Ibid.

⁸Ibid.

⁹Harvey J. Gordon, "Defense Equipment: Second Sourcing Production," Program Manager, July-August 1979.

¹⁰Lewis C. Watt, LTC USMC, "Mobilization of the Aviation Depot Maintenance Facilities," Unpublished Student Research Paper, Industrial College of the Armed Forces, Washington, D.C.: 1981, p. 2.

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