

GAO

Report to the Chairman, Subcommittee on  
Defense Industry and Technology  
Committee on Armed Services, U.S. Senate

February 1992

# DEFENSE INDUSTRIAL BASE

## DOD Needs Better Method of Identifying Critical Technology Funding



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**National Security and International  
Affairs Division**

B-244457

February 5, 1992

The Honorable Jeff Bingaman  
Chairman, Subcommittee on Defense  
Industry and Technology  
Committee on Armed Services  
United States Senate

Dear Mr. Chairman:

As you requested, we evaluated the Department of Defense's (DOD) methodology for identifying the funding for the designated critical technologies.

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**Background**

Public Law 101-189 requires the Secretary of Defense to prepare an annual Critical Technologies Plan beginning in 1989 that identifies technologies considered critical for ensuring the long-term superiority of U.S. weapon systems. During congressional hearings for the National Defense Authorization Act for Fiscal Year 1991, DOD was unable to provide detailed information on the funding of the critical technologies. This lack of information was cited during the hearings as a major obstacle in effectively managing the defense industrial base. After the hearings, DOD began to gather data on the funding levels of the critical technologies for use in complying with the legislative requirement.

The Office of the Secretary of Defense is responsible for coordinating the DOD data collection effort. The Office of the Secretary of Defense requested the military services and defense agencies to review their Science and Technology Programs and estimate funding for the critical technologies.

DOD funds the critical technologies directly through the Science and Technology Program<sup>1</sup> and indirectly through Independent Research and Development/Bid and Proposal (IR&D/B&P) costs.<sup>2</sup> Under the Science and Technology Program, military services and defense agencies finance research by universities, contractors, and government laboratories. In fiscal year 1991, DOD received \$8.5 billion for the Science and Technology Program. Contractors are reimbursed for their IR&D/B&P expenditures

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<sup>1</sup>The Science and Technology Program funds research that is directed by DOD.

<sup>2</sup>IR&D is independent research and development that is not specified under any government contract or grant. It is funded partly from contractor-controlled resources and partly funded through reimbursement in overhead. B&P costs are defined as those costs incurred in preparing, submitting, and supporting bids and proposals on potential government or nongovernment contracts. B&P efforts are funded in the same manner as IR&D.

through overhead in contract costs. In fiscal year 1990, contractors spent \$7.3 billion on IR&D/B&P, and over \$3.6 billion was reimbursed by the government.

## Results in Brief

The Office of the Secretary of Defense's methodology for identifying the funding for the designated critical technologies did not include

- collecting data on the extent to which defense contractors' use their IR&D/B&P funds to invest in the critical technologies,
- asking the military services to link funding to the specific technical goals contained in the plan, and
- developing data on actual expenditures.

In addition, the military services and defense agencies used different bases when responding to the Office of the Secretary of Defense's request for information.

## DOD Did Not Identify Contractors' Investment in the Critical Technologies

DOD gathered data on the extent to which Science and Technology Program funds were to be used on critical technologies. However, DOD did not gather information on whether contractors' IR&D/B&P expenditures were addressing the critical technologies, even though DOD indirectly funds contractors' IR&D/B&P programs. Without this information, DOD has no assurance that the funding for each critical technology was of the right magnitude. In response to a questionnaire we sent, 92 companies reported that they spent a total of \$2.9 billion of their IR&D/B&P expenditures on the technical goals contained in DOD's fiscal year 1990 Critical Technologies Plan.<sup>3</sup>

Appendix I contains data on the extent to which DOD funds the critical technologies. It also includes the data that the military services submitted to the Office of the Secretary of Defense.

<sup>3</sup>Additional information on the extent to which contractors' IR&D/B&P programs are addressing the critical technologies is contained in our report entitled Defense Industrial Base: Industry's Investment in the Critical Technologies (GAO/NSIAD-92-04, Jan. 15, 1992).

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## Funding of Specific Technical Goals Not Provided to the Congress

DOD did not instruct the services to link the funding information to the plan's technical goals, although this information would have provided added assurance that the plan was being carried out as intended. Each critical technology is defined by specific technical goals that are included in the Critical Technologies Plan. DOD has established (5, 10, and 15 year) technical goals for each critical technology area. These technical goals, according to DOD, are "visions of where the technology could be 5, 10, and 15 years from now."

We found that the services and defense officials could have provided data showing the funding for the technical goals, but DOD did not request this data. Our review also indicated that reporting funding information by specific technical goals could provide a clearer picture of priorities and allocation of the funding associated with the Critical Technologies Plan. For example, defense contractors informed us that they invested more than \$827 million on air breathing propulsion (a critical technology), but only 62 percent (\$516 million) of that amount was spent directly on the technical goals contained in DOD's Critical Technologies Plan. When we asked defense contractors to link funding to specific technical goals, contractors' investment in the critical technologies was reduced by a range of 4 percent to 38 percent for individual technologies.

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## Planned Funding Differs From Actual Expenditures

The funding information that DOD reported to the Congress on the critical technologies reflected estimated expenditures. Many factors can cause the planned spending levels on the critical technologies to change. The planned spending levels on the critical technologies could change throughout the DOD's Planning, Programming, and Budgeting System as well as during congressional deliberations. For example, in the 1991 budget submitted to the Congress, the Strategic Defense Initiative Organization planned to spend \$355 million on passive sensors and \$70 million on weapon system environment. However, the Congress significantly reduced Strategic Defense Initiative Organization's budget as well as changed the overall program direction. These actions reduced the Organization's planned expenditures on passive sensors to \$139 million, but increased weapon system environment to \$185 million.

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## Funding Estimates Not Based on a Consistent Methodology

The military services and defense agencies developed the funding information using differing methodologies. Four organizations used the 1990 Critical Technologies Plan and the other two organizations used a 1991 draft plan. There were some differences between the two plans. For example, the 1991 plan did not contain all of the same critical technologies as those listed in the 1990 plan. Furthermore, in some cases, even though many of the critical technologies remained the same from 1990 to 1991, some of the technical goals within the Critical Technologies Plan were changed or modified.

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## Recommendation

We recommend that the Secretary of Defense provide guidance to the military services and defense agencies to better identify the extent to which DOD is funding the Critical Technologies Plan. The guidance should require that the military services and defense agencies (1) describe the extent to which funding is linked to the technical goals, (2) report information on planned and actual expenditures, and (3) describe the extent to which funds spent on contractors' IR&D/B&P efforts are addressing the critical technologies.

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## Agency Comments and Our Evaluation

In providing official oral comments on a draft of this report, DOD generally agreed with the findings presented in the report, but disagreed with our recommendation. DOD believes that describing the extent to which funding is linked to the technical goals would not be a useful exercise at this time because the science and technology planning process (including critical technologies as a subset) is still evolving.

DOD pointed out that budget information on the science and technology program is precisely calculated and tracked carefully, whereas the funding data for critical technologies are only estimates. DOD stated that critical technologies are not aligned with budgets, and therefore information on planned and actual expenditures of critical technologies are not tracked carefully. DOD believes that the funding information on the critical technologies does not have to be "precise" and consists of an aggregate of many technical goals and activities.

We recognize that the budgetary program elements are not categorized by critical technologies. However, according to DOD officials, the critical technologies represent the most important technologies for advancing military capabilities. We believe that DOD should position itself to track planned and

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actual expenditures on critical technologies so that they align with its budgetary information on the overall science and technology program.

DOD also stated that information on the extent to which contractors' IR&D/B&P efforts are addressing the critical technologies might be of general interest but would have limited applicability to critical technologies planning.

In a recent report dealing with IR&D/B&P,<sup>4</sup> we indicated that contractors had spent almost 50 percent of their IR&D/B&P to address the technical goals in DOD's plan. Identifying IR&D efforts that industry is conducting would allow DOD to respond to gaps in the defense industrial base. IR&D is an important component of the defense industrial base that DOD should carefully consider in deciding where to invest its other research and development funds.

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## Scope and Methodology

To obtain the information for this report, we interviewed officials and reviewed documents at DOD's Office of the Director for Defense Research and Engineering, Department of the Air Force, Department of the Army, Department of the Navy, Defense Advance Research and Projects Agency, Defense Nuclear Agency, and the Strategic Defense Initiative Organization.

We also used the results of a questionnaire sent to 121 defense contractors listed in DOD's March 1990 report on IR&D/B&P costs.<sup>5</sup> Of the 121, 92 contractors responded. A copy of the questionnaire and the aggregated responses to the entire questionnaire are included in our January 1992 report on industry's investment in the critical technologies.

We conducted our work between February 1990 and September 1991 in accordance with generally accepted government auditing standards.

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We are sending copies of this report to the Secretary of Defense; interested congressional committees; and the Director, Office of Management and Budget. We will make copies available to others upon request.

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<sup>4</sup>Defense Industrial Base: Industry's Investment in the Critical Technologies (GAO/NSIAD-92-04, Jan. 15, 1992).

<sup>5</sup>Independent Research and Development and Bid and Proposal Cost Incurred by Major Defense Contractors in the Years 1988 and 1989, Defense Contract Audit Agency, March 1990.

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Please contact me at (202) 275-8400 if you or your staff have any questions concerning this report. Other major contributors to this report are listed in appendix II.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Paul F. Math". The signature is stylized with a large, sweeping initial "P" and "M".

Paul F. Math  
Director, Research, Development,  
Acquisition, and Procurement Issues





# DOD Funding of the Critical Technologies

**Table I.1: Science and Technology and IR&D/B&P Funding of the Critical Technologies**

Dollars in millions

Critical technologies	Science and technology funds invested in critical technologies		IR&D/B&P funds invested in critical technologies	
	Dollars	Percentage	Dollars	Percentage
Semiconductors materials	\$533	14.0%	\$340	11.9%
Passive sensors	420	11.1	272	9.5
Air breathing propulsion	374	9.9	516	18.1
Simulation and modeling	297	7.8	51	1.8
Weapon system environment	294	7.7	243	8.5
Signal processing	228	6.0	273	9.5
Composite materials	204	5.4	199	7.0
Sensitive radars	169	4.5	149	5.2
Photonics	166	4.4	117	4.1
Machine intelligence/robotics	154	4.0	83	2.9
Hypervelocity projectiles	143	3.8	40	1.4
Signature control	123	3.2	N/A <sup>a</sup>	N/A <sup>a</sup>
Computational fluid dynamics	120	3.2	104	3.6
Software producibility	111	2.9	141	4.9
Parallel computer architecture	108	2.8	150	5.2
Data fusion	88	2.3	102	3.6
Pulsed power	84	2.2	17	0.6
High energy density materials	82	2.2	39	1.4
Superconductivity	55	1.5	13	0.4
Biotechnology	42	1.1	9	0.3
<b>Total</b>	<b>\$3,795</b>	<b>100.0%</b>	<b>\$2,858</b>	<b>100.0%</b>

<sup>a</sup>Not available (N/A).

Source: Data on science and technology funding is based on fiscal year 1991 information provided by the military services and defense agencies to the Office of the Secretary of Defense. Data on IR&D/B&P funding is based on the results of 92 defense contractors responding to our questionnaire.

**Appendix I  
DOD Funding of the Critical Technologies**

**Table I.2: Extent to Which Defense Organizations Participating in the Science and Technology Program Invested in the Critical Technologies for Fiscal Year 1991**

Dollars in millions

<b>Organization</b>	<b>Science and technology</b>	<b>Critical technologies</b>	<b>Percent</b>
Defense Advanced Research Projects Agency	\$1,401	\$1,181	84
Air Force	1,428	900	63
Navy	1,145	507	44
Army	1,299	486	37
Strategic Defense Initiative Office	2,863	651	23
Defense Nuclear Agency	406	68	17
<b>Total</b>	<b>\$8,542</b>	<b>\$3,794</b>	<b>44</b>

Source: Data submitted by military services and defense agencies to the Office of the Secretary of Defense.

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# Major Contributors to This Report

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