

Assessment of Industry Attitudes on Collaborating
With the U.S. Department of Defense in
Research and Development and Technology Sharing

Prepared for The U.S. Department of the Air Force
By Trotta Associates, Inc

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Findings and Recommendations

This assessment was undertaken by Trotta Associates in collaboration with the U.S. Department of Commerce at the request of the U.S. Department of the Air Force to review attitudes of private companies toward sharing new or promising technologies developed for commercial use with the Department of Defense (DoD). It is thought that DoD can leverage technologies developed for the commercial market and benefit by saving research and developmental costs for materials and components needed in new weapon systems or to enhance the performance of existing systems. The Commerce Department conducted a survey to collect the appropriate information and prepared the database.

To facilitate analysis, the survey responses were divided into two major sub-groups: defense contractors and non-defense contractors. The expectation was that defense contractors would in most cases respond more favorably to most questions in the survey; and thereby, they would offer a basis for comparison. Under this criteria, not counting the special category, 427 firms responded to the survey, of whom 158 (37%) were classified as defense contractors. In addition, 44 companies in the special category responded, bringing the total response to 471.

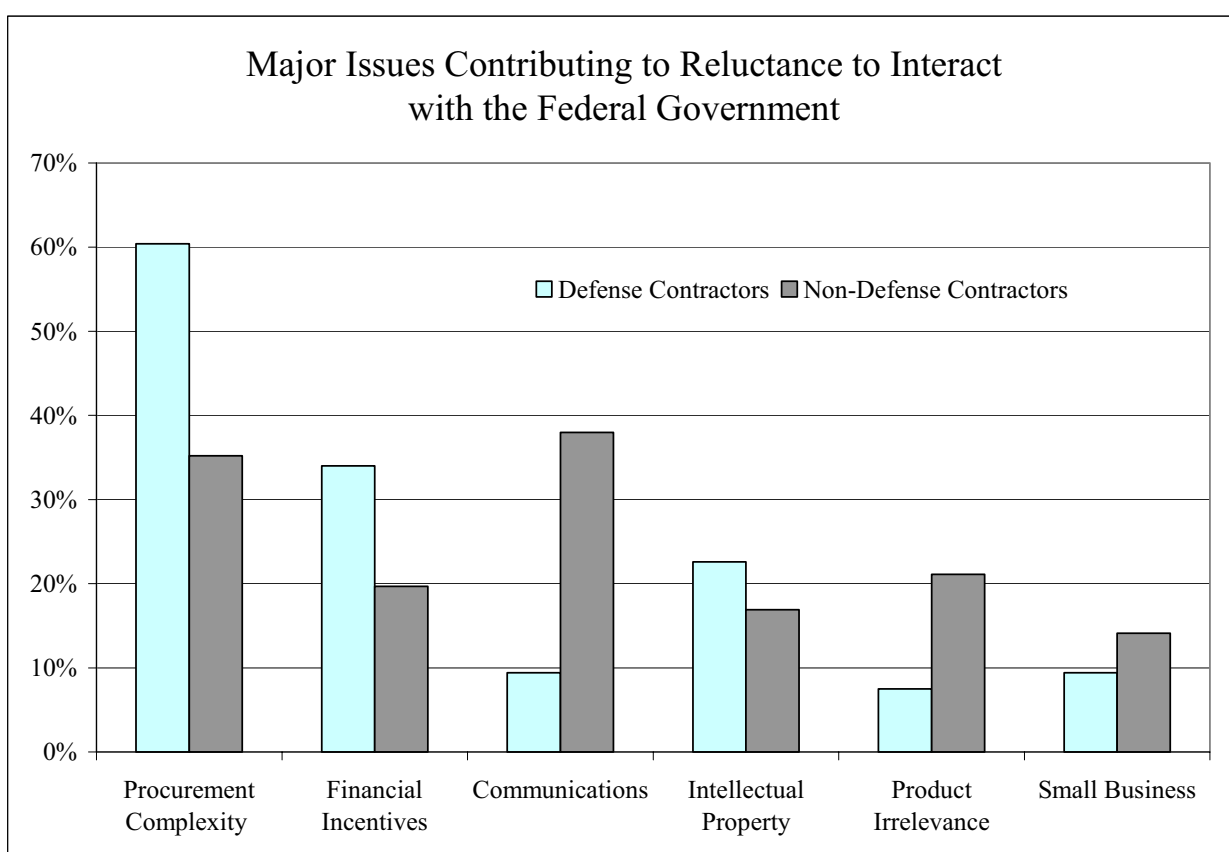
1.1 Survey Findings

- About 85 percent of the surveyed firms have an R&D program.
- Motivations to communicate information about R&D and technology programs were the potential for landing contracts or grants from the public sector or to alert the commercial market in anticipation of future sales. Non-defense contractors were strongest in alerting the commercial market, but were generally weak in all motivations with regard to the public sector.
- Methods to inform others of R&D and technology activities strongly favored one-on-one briefings and presentations at technical meetings. An emerging method appears to be through business web pages. Non-defense contractors were weak in their responses regarding the public sector.
- Reluctance to discuss R&D programs was responded to by about 45 percent of the companies, so we assume over 50 percent are not reluctant. However, the main concerns appear to be the adequacy of funding and the difficult environment in working with the federal government.

- Constraints on firms from increasing interaction with the public sector were inadequate funding and a lack of information. Non-defense contractors also considered smaller business size an important constraint.
- Involvement with DoD might be greater for many firms if it were easier to identify opportunities and firms were given more timely notification.
- About one-third of defense contracting companies reported they confer, or seek the assistance of the federal government on basic or applied research, or engineering and development. Less than 5 percent for non-defense contractors reported they did so.
- Few companies have formed agreements, such as joint ventures or CRADAs with any federal government agency since 1998.
- Nearly two-thirds of defense contractors would be willing to place R&D project information in a restricted access DoD database. Non-defense contractors were less willing at 41 percent.
- Factors that influenced their decision not to participate in a DoD database were concerns over (risk of) loss of proprietary data, no economic benefit, and loss of competitive advantage. Non-defense contractors also reported too much staff time required.
- Government contracting and procurement procedures that discourage firms from seeking public sector opportunities were uncertainty of government funding and government demand for their products. Companies also cited narrow profit margins, complex solicitations, and frequent re-competitions. Non-defense contractors cited DoD cost accounting standards, payment delays, and cycle times between bid and award.
- The most preferred method to become aware of government opportunities by a wide margin was by e-mail for both groups of contractors. Other methods included broad agency announcements, advanced planning briefings with industry, and a central DoD website.
- The chief reason some firms stopped supplying DoD in recent years was that the commercial market was more profitable. In addition, some cited the decrease in defense demand and onerous acquisition regulations.

1.1.1 Why Firms Hesitate to Deal with DoD

Many companies that indicated a reluctance to discuss their R&D and/or technology programs with the federal government submitted written comments regarding how to reduce or eliminate their concerns. These comments were sorted into six basic issue categories as enumerated on the chart below. Some companies submitted multiple comments, which could be parceled into two or three different issue categories. This resulted in more total comments than companies. Thus, 53 defense contractors submitted 76 comments and 71 non-defense contractors submitted 103 comments. The comments, arrayed by percent of companies citing each issue, are shown on the following chart.



1.1.1.1 *Procurement Complexity*

This is the number one issue cited by defense contractors. The regulatory environment and bureaucracy impose costs on private companies that discourage and sometimes prevent companies from interacting with the federal government. They argue the government process differs greatly from their experience in commercial markets. The federal marketplace causes

them to hire extra people to comply with the added and specialized paperwork and to use older equipment because of the government approval process; the older equipment may not be suitable in a competitive commercial market. The companies are also concerned about speed to market and shorter product cycles, which again are critical in a competitive commercial market. In brief, these added costs are passed through to the government. In addition, some commercial opportunities may be forgone or lost because additional resources and time are used up in the process. This issue is of great enough magnitude to force some companies to exit the field.

1.1.1.2 Financial Incentives

The stability and adequacy of federal budgets and program funding is determined politically. This means funding can be stretched out, reduced, or canceled on short notice. This makes investments in government programs risky and sometimes hazardous. Regulatory control limiting profits, one-year contracts, and slow moving paperwork do not help the situation.

1.1.1.3 Communications

This is the number one issue cited by non-defense contractors. Communication requires initiative by sender and receiver, a two-way street. This issue is much larger for non-defense contractors, especially those that lack knowledge and experience as to how to obtain information about public opportunities accurately and efficiently. The major hurdle (or cost) confronting inexperienced companies is reaching a threshold of competence in acquiring information. Most companies indicated they prefer one-on-one contacts and technical meetings as methods of communicating. Additionally, e-mail has become a major (and very cheap) and preferred method of communication.

1.1.1.4 Intellectual Property

Competitive knowledge and information costs money to develop and protect, and has value in the marketplace. Intellectual property can be the lifeblood of a firm. Intellectual property may include engineering know-how, designs, strategic plans, manufacturing processes, or knowledge of emerging markets. Many companies consider sharing intellectual property with the government a risk, especially if it also has commercial application. The federal government should train its people to protect business proprietary information with legal penalties supporting its protection. Protection should also be a standard element of contracts unless waived by the contracting owner of the proprietary information at issue.

1.1.1.5 Product Irrelevance

The product differences issue includes products that are not useful to the federal government, company structures or orientation not conducive to interaction with the federal government, companies that do not engage in R&D, and companies firmly committed to the commercial market.

1.1.1.6 Small Business

Small business is at a cost disadvantage in complying with paperwork and other government regulations that impose costs. Smaller companies may excel at build-to-print on a cost competitive basis because of low overhead and quick turnaround. Small firms rarely engage in formal research, although individuals employed by these firms may discover things in their day-to-day work. The smartest people tend to migrate to larger firms where the salary and opportunity is thought superior.

1.2 Company Recommendations

Many companies offered specific recommendations in their comments to reduce or eliminate concerns about discussing their technologies with the federal government. The comments were organized

1.2.1 Procurement Complexity

1. Adopt closer adherence to commercial contract and accounting practices.
2. Remove requirements that force companies to maintain two separate legal entities and financials.
3. Make use of more efficient contracting such as cooperative agreements and other transactions.
4. Make it easier to find the correct person or department to speak with.
5. Adopt more multiyear procurements.
6. Stick to long-term commitments.
7. In many cases government labs compete with industry.

1.2.2 Financial Incentives

1. More government funding needed for dual use technology and transition.
2. Make more basic science and research funds available.
3. Allow companies a greater return on investment.
4. Offer tax and other incentives to collaborate with DoD.
5. Reward innovation and cost savings
6. Improve timing of payments.
7. Shorten time required to award a contract.
8. Increase order volumes.

1.2.3 Communications

1. DoD should research available commercial work before funding redundant competitive work.
2. Have regular information sessions.
3. Provide information to industry identifying capabilities available at the labs.
4. Expand communication of collaborative opportunities and federal grant requirements.
5. DoD should make public lists of technologies it is seeking.

1.2.4 Intellectual Property

1. Update R&D IP clauses to reflect commercial partners.
2. DoD should not allow a company's unique product to be copied by other firms.
3. Keep proprietary information protected.

1.2.5 Small Business

Reduce or eliminate growing requirement for cost sharing for small businesses.

PART I – Database Description

2. Introduction

2.1 Background

This assessment was undertaken by Trotta Associates at the request of the U.S. Department of the Air Force to review attitudes of private companies toward sharing new or promising technologies developed for commercial use with the Department of Defense (DoD). It is thought that DoD can leverage technologies developed for the commercial market and benefit by saving research and developmental costs for materials and components needed in new weapon systems or to enhance the performance of existing systems.

Trotta Associates requested the U.S. Department of Commerce, Bureau of Industry and Security, Office of Strategic Industries and Economic Security (BIS) to collect industrial information needed for this review. BIS has authority under section 705 of the Defense Production Act of 1950, as amended (50 U.S.C. 2061-2170), Executive Order 12656, and Executive Order 12919 to obtain basic economic and industrial information from private concerns where pertinent to national defense needs.

Four technology areas were selected for review: *Storage Batteries*, *Power Electronics*, *Advanced Composites*, and *Wireless Broadband*. The selection of these particular technologies was essentially based on three criteria: 1) areas important to DoD, 2) technologies driven by commercial markets, and 3) areas with different industry structures and market forces.

Written surveys were prepared and disseminated to industry in the fall of 2001 and a follow-up mailing was sent to delinquent companies in June 2002. The purpose of the surveys was to gather information on industry attitudes on collaborating with the DoD on research and development projects and technology. Surveys were sent to 1,064 companies representing the four technologies. An additional 47 surveys were included at the specific request of the Air Force as a special category and sent primarily to companies in the aerospace and electronics field.

A total of 629 companies responded to the survey and of these 491 provided usable data. Unusable surveys included 124 companies exempted from completing the document and 14 others that were no longer in business. In addition, 87 companies were not at the surveyed address and their mailing packets were returned unopened. The 629 figure includes all

companies recorded or entered into the database by September 30, 2002. The following table provides a tally of the survey responses for each technology.

Record of Technology Surveys			
Category	Received	Mailed	% Returned
Advanced Composites	130	299	43.48%
Batteries	55	134	41.04%
Power Electronics	130	300	43.33%
Wireless Broadband	132	331	39.88%
Special	44	47	93.62%
Sub Total	491	1,111	44.19%
...Bad Addresses		-87	
Adjusted Total		1,024	
...Exemptions	124		
...Out of Business	14		
Unusable Responses	138		
Adjusted Results	629	1,024	61.43%

Not all surveys were completed in their entirety. Some respondents left portions of their returned surveys unanswered. This, however, should not affect the statistical results, since a large enough sample was received. A copy of the survey document is attached as Appendix I.

2.2 Technologies Under Review

2.2.1 Advanced Composites Manufacturers

Advanced composites are generally defined as a family of lightweight structural materials with reinforcing fibers such as carbon or high strength fiberglass embedded in a matrix material. Advanced composites are generally distinguished from other reinforced materials by the use of these continuous high-stiffness, high-strength fibers. Advanced composites have gained broad usage in aerospace and defense applications including aircraft, land vehicles, spacecraft, and ships. Ruggedness and reliability are major differences between commercial and military applications.

2.2.2 Batteries

Batteries convert potential chemical energy into electrical energy. Such devices include: alkaline cell storage batteries, rechargeable batteries, and lead-acid storage batteries, and batteries of nickel cadmium, nickel hydrogen, and nickel metal hydrides. Research is being conducted on advanced batteries composed of lithium-aluminum/metal sulfide, lithium polymer, and nickel/metal hydride.

The commercial battery industry is driven by market needs for small long lasting cost effective rechargeable batteries. Batteries are the limiting factor in the design of products requiring long life, low drain. Cost seems to be the principal driver for much of the commercial market. While there are special items (e.g., laptop computer batteries, space craft batteries, etc.) where this is not necessarily the case, the high volume in most markets makes cost (not performance) a major competitive factor. DoD, on the other hand, has need of a more limited number of high reliability, long life, light weight devices to power the new generation of military equipment carried by the modern soldier. There is also need for long storage life, highly reliable batteries for various weapons applications. In defense applications, cost is less a factor than weight or performance.

2.2.3 Power Electronics

Power electronics are based on solid state electronics technology and include programmable logic controllers. More specifically, they are programmable universal electrical power converters and controllers with no moving parts. They can convert direct current from a battery to alternating current equivalent to utility power and vice versa, control the speed of any kind of motor, or control the load on any kind of electrical generator or alternator. Enabling technologies are the development of high-speed, high-powered, high-efficiency (low forward voltage drop) semiconductors such as the MOS-controlled thyristor (MCT) and highly efficient soft-switching flexible inverter electrical circuit topologies such as the Auxiliary Resonant Commutated Pole (ARCP) inverter. Applications include: power control and conversion requirements needed in fuel cells, wind power electrical generation, direct current (DC) to alternating current (AC) power conversion and AC to DC conversion. Ruggedness and reliability are the major differences between commercial and military applications.

The power electronics industry encompasses an array of markets including: computers, telecommunications, industrial equipment controls, aerospace, and power generation and distribution, which are heavy users of power electronics. Specific products include ac/dc power

supplies, surge protectors, power-conditioning devices, and uninterruptible power systems,

2.2.4 Wireless Broadband

Wireless communication equipment refers to complete radio based communication systems including mobile switching, transmission and subscriber equipment for the provision of cellular paging and personnel communication services. Wireless broadband equipment delivers high-speed digital communication over a wireless medium between two separate sites. With today's networks expanding geographically and struggling to maintain data-optimized and high-bandwidth connectivity, broadband wireless is quickly emerging. The major performance differences would seem to be in overall system transportability (especially the fixed components such as relay stations, etc.)

Operating in the 20 to 30 gigahertz end of the Ka-band spectrum, satellites also will provide another avenue of broadband wireless data transmission.

3. Characteristics of Companies in the Survey Sample

3.1 Company Legal Status

The great majority of companies responding to the survey identified themselves as corporations. Of the 481 firms that answered the question about their legal status on the first page of the survey, 436 or 90.6 percent were the corporate form. The second most popular legal status was the Limited Liability Company, or Subchapter S Corporation, which is a hybrid between a sole proprietorship or limited partnership and a general corporation. About six percent, 29 companies in all, identified themselves as having this structure. Limited Partnerships were about 1.5 percent, while all other legal structures were each less than 1 percent.

Legal Status of Firms in Database (Percent Distribution by Technology and Number of Firms)						
Technology	Sole Proprietor	Cooperative	Limited Partnership	Limited Liability Corporation	Partnership	Corporation
Adv Comp.	0.0%	0.8%	3.1%	7.8%	2.3%	86.1%
Batteries	0.0%	1.9%	0.0%	3.8%	1.9%	92.5%
Power El	1.6%	0.0%	0.8%	9.4%	0.0%	88.3%
Wireless	0.0%	0.8%	0.8%	2.3%	0.0%	96.1%
Special	0.0%	0.0%	2.3%	4.7%	0.0%	93.0%
Total	0.4%	0.6%	1.5%	6.0%	0.8%	90.6%

Most of the surveyed companies manufacture products. Based on legal status, they are probably larger in size than the average manufacturing company and in most cases rank in the upper 10 percent. The high use of the corporate form among surveyed respondents is almost double the national average, which is about 47 percent for manufacturers. U.S. manufacturing is comprised of more than 360,000 companies, two-thirds of whom are firms with fewer than 20 employees. Corporations represent 86 percent of all manufactured sales revenues, and are especially predominant among companies with more than \$25 million in annual revenues. Nationally, Limited Liability Companies account for about one-third of the legal status (versus six percent in the survey sample) and about 12 percent share of manufacturing sales revenues. Another 15 percent of manufacturing firms in the United States are sole proprietorships and 4.2 percent were partnerships, and these together represent only two percent of sales.¹

¹ 1997 Economic Census, Company Statistics Series, EC97CS-1, Issued September 2001, U.S. Department of Commerce, Economic and Statistics Administration, Census Bureau, Page 476

3.2 Foreign Ownership

Forty-seven companies reported a foreign parent firm. Twelve of the parent firms were headquartered in the United Kingdom, six each in Germany and Japan, four in France, three in Canada and the Netherlands, and two in Israel and Taiwan. Nine countries had one each, including Switzerland, Norway, Hong Kong, Bermuda, Republic of China, Finland, Australia, Denmark, and Italy. The foreign headquartered parent firms were generally well known large international companies with R&D functions performed in the foreign country. Several of the firms were listed more than once, reporting for multiple technologies. The Bermuda firm was an American firm headquartered there presumably for tax purposes.

3.3 Primary Business Activities

Information on the surveyed companies' major business activities was requested in Part II Products and Services on page 1 of the survey. A total of 482 firms completed this information. Close to 84 percent of these firms reported manufacturing and 53 percent reported design as major activities in which their companies engage. Assembly operations were reported by about 38 percent, and research by one-third of the respondents.

The numbers varied by technology group. In the case of advanced composites companies, more than 95 percent identified themselves as manufacturers, the highest percentage within any group. However, advanced composite firms had the lowest proportion of firms in each of the other business activity areas, usually by a wide margin. This in part is due to the large number of smaller firms engaged in the technology; plus the production process is more labor intensive than the others, and economies of scale opportunities appear to be lacking, given the current market and technology. Moreover, as shown above advanced composites had the lowest percentage of corporations as a legal structure at 86 percent. The following table presents the major business activities by technology group.

Major Activities Engaged in by Surveyed Firms (Number of Firms Reporting Each Activity)							
Technology → ↓ Activity Areas	Advanced Composites	Batteries	Power Electronics	Wireless Broadband	Sub Total	Special	Total
Manufacturing	123	48	94	99	364	39	403
Design	21	24	86	93	224	30	254
Assembly	15	23	60	53	151	31	182
Research	19	22	53	49	143	19	162
Test & Evaluation	13	17	43	36	109	22	131
Integration	2	7	40	40	89	19	108
Fabrication	14	6	35	15	70	21	91
Exporter	12	11	16	28	67	7	74
Repair & Overhaul	4	3	19	23	49	20	69
Importer	7	11	8	8	34	3	37
Other	0	3	8	19	30	7	37
Inspection	0	1	4	6	11	6	17
# of Respondents	129	54	126	130	439	43	482
Percent of Firms Reporting Each Activity							
Manufacturing	95.4%	88.9%	74.6%	76.2%	82.9%	90.7%	83.6%
Design	16.3%	44.4%	68.3%	71.5%	51.0%	69.8%	52.7%
Assembly	11.6%	42.6%	47.6%	40.8%	34.4%	72.1%	37.8%
Research	14.7%	40.7%	42.1%	37.7%	32.6%	44.2%	33.6%
Test & Evaluation	10.1%	31.5%	34.1%	27.7%	24.8%	51.2%	27.2%
Integration	1.6%	13.0%	31.8%	30.8%	20.3%	44.2%	22.4%
Fabrication	10.9%	11.1%	27.8%	11.5%	16.0%	48.8%	18.9%
Exporter	9.3%	20.4%	12.7%	21.5%	15.3%	16.3%	15.4%
Repair & Overhaul	3.1%	5.6%	15.1%	17.7%	11.2%	46.5%	14.3%
Importer	5.4%	20.4%	6.4%	6.2%	7.7%	7.0%	7.7%
Other	0.0%	5.6%	6.4%	14.6%	6.8%	16.3%	7.7%
Inspection	0.0%	1.9%	3.2%	4.6%	2.5%	14.0%	3.5%

Most companies in the data sample engage in several of the above listed activities, and a few companies engage in all or nearly all of them. Generally, companies that engage in multiple activities are both larger and possess a broader range of capabilities; not surprisingly, these larger companies are also more likely to interact with DoD. Overall, the typical company engaged in 3.27 of the listed business activities. This estimate is based on a tally of 467 firms that provided this information and also responded to question 11 on page 17 of the survey, which allows segregation of companies that have contracted with the U.S. Department of Defense in recent years from those that have not. A hypothesis that the former group generally engages in more business activities proved to be correct. The results are presented in the following table. The column on the far right, labeled “Total,” shows that respondents with DoD contracts engaged in an average of 4.31 major activities, while those that did not averaged only 2.51 areas.

Range of Activities Engaged In by Defense Contractors vs. Non-Defense Contractors (number of activities per firm; averaged by technology)							
	Advanced Composites	Batteries	Power Electronics	Wireless Broadband	Sub- Total	Special	Total
A. DoD Contractors	2.62	3.92	4.35	4.35	4.06	5.36	4.31
B. Non-DoD Contractors	1.64	2.56	3.02	3.15	2.49	3.75	2.51
Overall	1.81	3.20	3.73	3.60	3.07	5.21	3.27
% Difference (A/B)	59%	53%	44%	38%	63%	43%	72%
Number of Respondents							
A. DoD Contractors	21	24	65	48	158	39	197
B. Non-DoD Contractors	101	27	57	81	266	4	270
Overall	122	51	122	129	424	43	467
% DoD Contractors	17.21%	47.06%	53.28%	37.21%	37.26%	90.70%	42.18%

3.4 Business Integration Indicators

Part II - Question 3 on page 1 of the survey asked companies to identify activities they perform in-house versus those they contract out. Business integration as used here simply refers to the extent a firm performs various activities in-house, or within the company. This could apply to vertical integration or horizontal integration, or a combination of both. A total of 465 companies responded to the question. Respondents included 156 defense contractors, 265 non-defense contractors, and 44 companies in the special category. In general, companies in each technology perform their own R&D, create their own products, and rely on in-house design and engineering. About one-third of the companies also manufacture most of their own parts, while less than one-fourth purchase more than half the parts they use. In addition, about one in eight firms largely manufacture on a build-to-print basis.

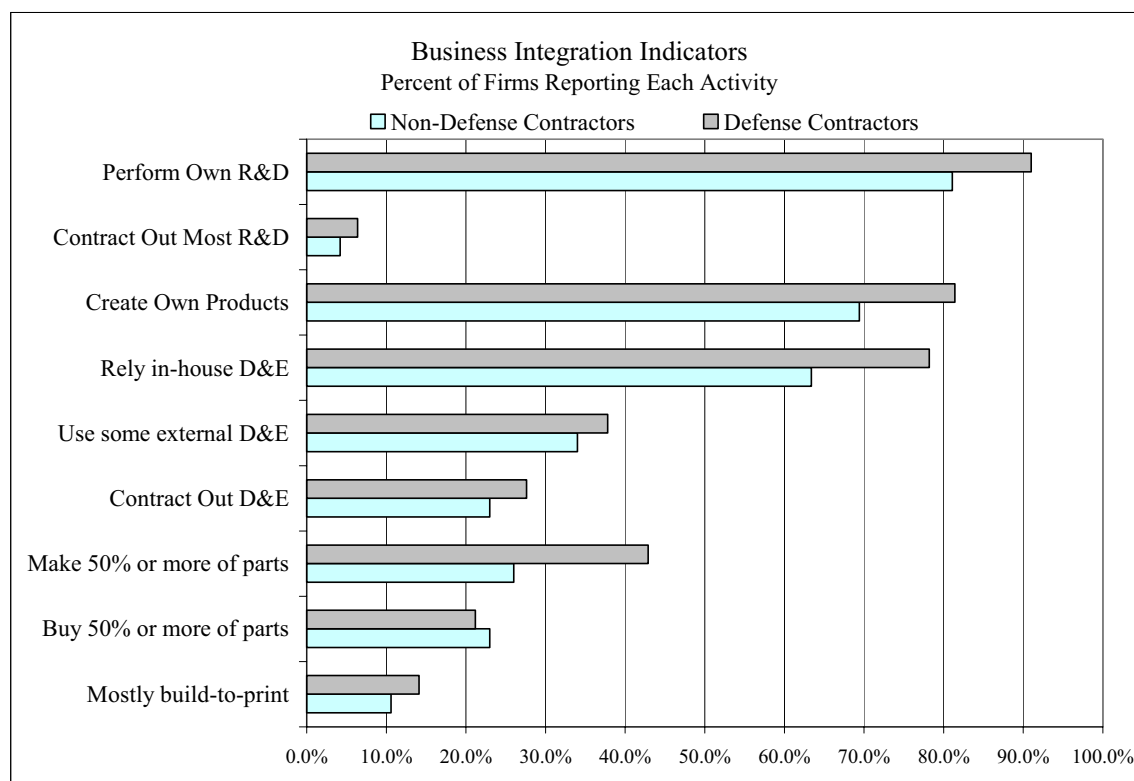
The responses to these activities differed in magnitude between both non-defense and defense contractors, and across technologies. Defense contractors, for example, scored higher than non-defense contractors in terms of self-reliance indicators. That is, relatively more defense contractors perform their own R&D, create their own products, and a higher percentage rely on in-house design and engineering. In addition, 43 percent of defense contractors manufacture at least 50 percent (or more) of their own parts, while non-defense contractors recorded only 26 percent. As for build-to-print, defense contractors were slightly more than non-defense companies, 14 to 11 percent, although the function was a minor portion of the either sector's activity. The following table highlights the survey responses by contractor status and technology.

Integration Profile of Companies by Technology and Status as Non-Defense or Defense Contractors										
Technology	Number of Companies: Total	Perform own R&D	Contract out most R&D	Create own products	Rely on in-house Design & Engr.	Use Internal/external Design & Engr.	Contract out Design & Engr.	Manufacture 50% of parts in-house	50% or more of parts contracted out	Largely manufacture on build-to-print basis
	Number of Defense Contractors Reporting in Each Area									
Adv Comp	21	17	2	18	13	7	3	8	1	6
Batteries	24	21	1	20	21	5	5	13	4	3
Power El	63	59	4	50	52	28	19	25	15	10
Wireless	48	45	3	39	36	19	16	21	13	3
	Number of Non-Defense Contractors Reporting in Each Area									
Adv Comp	101	82	4	68	53	35	21	30	3	18
Batteries	27	17	3	19	17	10	5	8	7	2
Power El	56	45	1	39	38	17	14	15	16	4
Wireless	81	71	3	58	60	28	21	16	35	4
	Totals of Defense and Non-Defense Contractors and Special Category									
Non-DoD	265	215	11	184	168	90	61	69	61	28
DoD	156	142	10	127	122	59	43	67	33	22
Special	44	32	1	29	30	18	15	20	13	10
Grand Total	465	389	22	340	320	167	119	156	107	60
	Percent of Defense Contractors Reporting in Each Area									
Adv Comp	21	81.0%	9.5%	85.7%	61.9%	33.3%	14.3%	38.1%	4.8%	28.6%
Batteries	24	87.5%	4.2%	83.3%	87.5%	20.8%	20.8%	54.2%	16.7%	12.5%
Power El	63	93.7%	6.3%	79.4%	82.5%	44.4%	30.2%	39.7%	23.8%	15.9%
Wireless	48	93.8%	6.3%	81.3%	75.0%	39.6%	33.3%	43.8%	27.1%	6.3%
	Percent of Non-Defense Contractors Reporting in Each Area									
Adv Comp	101	81.2%	4.0%	67.3%	52.5%	34.7%	20.8%	29.7%	3.0%	17.8%
Batteries	27	63.0%	11.1%	70.4%	63.0%	37.0%	18.5%	29.6%	25.9%	7.4%
Power El	56	80.4%	1.8%	69.6%	67.9%	30.4%	25.0%	26.8%	28.6%	7.1%
Wireless	81	87.7%	3.7%	71.6%	74.1%	34.6%	25.9%	19.8%	43.2%	4.9%
	Percent Totals of Defense and Non-Defense Contractors and Special Category									
DoD	156	91.0%	6.4%	81.4%	78.2%	37.8%	27.6%	42.9%	21.2%	14.1%
Non-DoD	265	81.1%	4.2%	69.4%	63.4%	34.0%	23.0%	26.0%	23.0%	10.6%
Special	44	72.7%	2.3%	65.9%	68.2%	40.9%	34.1%	45.5%	29.5%	22.7%
Grand Total	465	83.7%	4.7%	73.1%	68.8%	35.9%	25.6%	33.5%	23.0%	12.9%

The greater degree of self-reliance among defense contractors reflects in part the uniqueness of the defense market, and possibly the difficulties defense procurement regulations impose on

lower-tier subcontractors, that otherwise must compete primarily in commercial markets. The defense market tends to be more rigorous in terms of paperwork and specifications, and often distinguished by irregular orders in smaller shipment quantities. These characteristics can wreak havoc on business efficiency and productivity, and in extreme cases price a firm out of commercial markets. More of the work in this market, therefore, is likely to be brought in-house.

The graph that follows shows the differences between defense and non-defense contractors respecting integration. The reader is reminded that most defense contractors also have sizable commercial sales. The differences in integration are, therefore, probably greater than shown.



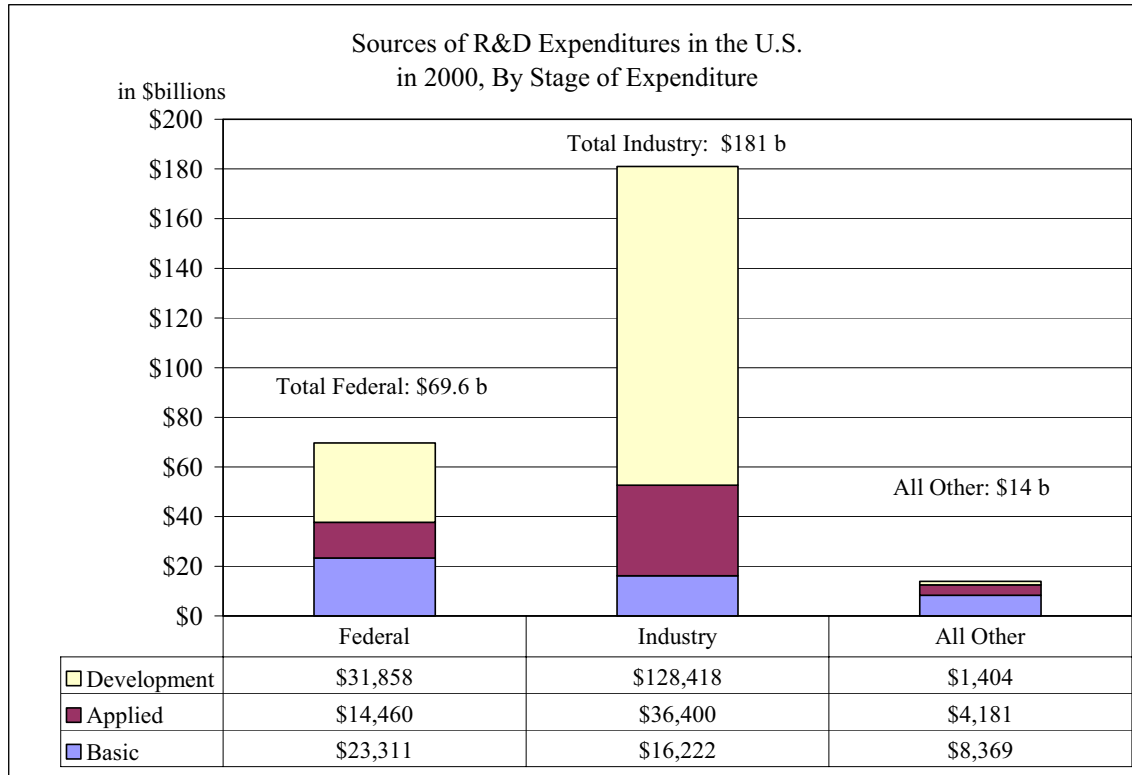
In contrast, the commercial market is more price/cost driven, standardized in its products, higher volume oriented, and worldwide in scope. In short, the commercial sector is more efficient, the defense sector more specialized. The defense sector has less volume over which to amortize overhead, which makes overhead a higher cost factor. Despite these differences, the two markets to a greater or lesser extent will also overlap, often using the same equipment and people to provide product to both markets.

Overall, 389 of 465 firms responding perform all or some of their own R&D; 16 of these contract out most of their R&D and another six companies farm out all of their R&D, indicating 395 firms (of 465) have R&D programs. Percentage-wise, about 80 percent of the companies perform R&D in-house exclusively, and an additional four percent perform at least some in-house. Add in those that farm out all R&D, and 85 percent of the firms (i.e., 17 of 20) responding to the survey have R&D programs.

Most of the respondents did not report R&D to be a major activity of their business, based on the previous section (2.3 Primary Business Activities). In fact, only about one-third of the companies indicated “research” was a “primary activity.” This could be taken to mean that the other two-thirds did not consider R&D a critical activity of their business, or they have small programs. If taken literally, perhaps many of these companies are not engaged in any significant “research” per se, but may be focused primarily on “development.” Development is very close to ready-to-market, and has a high probability of success. In addition, development can also be costly relative to basic or applied research because it involves the building, tweaking, and testing of prototypes. Basic research is far more risky, and applied research, while less risky, has a lower success rate than development; and these risks impose constraints on the use of corporate capital.

The National Science Foundation publishes statistics that show the lion’s share of industry’s R&D expenditures go for “development” as opposed to basic or applied research. In 2000, of \$265 billion spent on R&D; industry furnished \$181 billion, the federal government, \$70 billion, and all others (i.e., state governments, academic institutions, and non-profit organizations), another \$14 billion. Development expenditures accounted for \$162 billion (61 percent), with \$128 billion (79 percent) contributed by industry. The federal government, primarily from Department of Defense, supplied \$32 billion, the bulk of the remaining 20 percent. The following graph presents the NSF data.²

²SOURCE: National Science Foundation, Division of Science Resources Studies (NSF/SRS), National Patterns of R&D Resources: 2000 Data Update, NSF 01-309 (Arlington, VA, March 2001). Available at: <http://www.nsf.gov/sbe/srs.nsf01309/start.htm>.



Nationally, about 61 percent of the R&D was characterized as development, 21 percent as applied research, and 18 percent as basic research. The federal government supplied about 50 percent of the basic research funds, while industry supplied another third. Of the applied research, industry's share was much greater at about two-thirds of the total, while the federal government was about one-quarter.

In comparing the four technologies with respect to integration parameters, more similarities are apparent than important differences. Defense contractors, for example, were almost uniformly more integrated than their commercial counterparts regardless of the technology. As for notable differences, the commercial side of batteries scored low in number of firms performing their own R&D; as a corollary they also scored highest in contracting out R&D. Advanced composites led all others in build-to-print, while wireless broadband had the lowest ratio of firms in that area. However, wireless was highest in contracting out 50 percent or more of its parts; and was also the leader in performing R&D in-house and in contracting out design and engineering work.

3.5 Financial Indicators

Part III – Question 1 on page 2 of the survey asked the companies for financial information from 1998 thru 2002. Data for 2001 and 2002 were projected. Of 471 companies returning surveys with information on page 2, a total of 386 firms (82%) provided completed or partially completed financial statistics. About 45 percent (214) of the companies responded with complete statistics (i.e., five years of net sales, cost of goods sold, and net profits). The statistics were estimated upward as if all 471 firms in the respondent pool had filed complete information; however, they do not purport to represent total values in any of the described sectors. In addition, an unknown and probably major portion of most values in the described sectors include “unrelated products,” which could not be disaggregated. The battery sector may be the purest, although not all firms the sector were canvassed.

Estimates of financial parameters were derived from “complete” responses because they provided five years of solid statistical information, which could be used to establish trends for each technology sector. These five-year trends were factored upwards based on all reported 2000 data, and then increased proportionately to the number of firms in the respondent pool.³ The following table provides the response breakdown for each technology sector.

Record of Response to Financial Query						
Defense Status	Technology	Respondent Pool	Usable* Responses	Complete Responses	Percent Usable	Percent Complete
Non-Def	Adv Comp	102	84	51	82.4%	50.0%
Non-Def	Batteries	27	25	14	92.6%	51.9%
Non-Def	Power El	58	49	20	84.5%	34.5%
Non-Def	Wireless	82	68	25	82.9%	30.5%
Def	Adv Comp	21	15	8	71.4%	38.1%
Def	Batteries	24	19	13	79.2%	54.2%
Def	Power El	65	49	31	75.4%	47.7%
Def	Wireless	48	41	26	85.4%	54.2%
Both	Special	44	36	26	81.8%	59.1%
	Totals	471	386	214	82.0%	45.4%

*Usable responses refers to companies that provided any financial information, whether complete or not.

³ From the table above, five years of net sales were established for advanced composite non-defense contractors using 51 complete responses. Then, the 2000 value was calculated for 84 usable responses, and compared to the 2000 value from the 51 responses. This ratio was used to increase each year’s data. Lastly, the ratio between the 102 firms in the respondent pool and the 84 usable firms was used to increase and estimate the sector’s financial results.

Estimated net sales for all sectors combined ranged from \$170 (1998) to \$201 billion (2000). The special category, comprising 44 respondents, accounted for about one-quarter of the sales. Non-defense contractors represented another 40 percent and defense contractors about one-third. Keep in mind that a probably majority of the defense contractor sales were non-defense. In fact, actual sales to the Department of Defense may be less than 10 percent of the totals. However, these sales, regardless of their end-markets, ultimately support the companies' research programs.

SUMMARY INFORMATION Estimated Financial Indicators (in \$millions)							
Financial Measure	1998	1999	2000	2001*	2002*	5-yr Total	5-yr Ratios
TOTAL NON-DEFENSE CONTRACTORS							
Net Sales	\$64,414	\$67,909	\$89,633	\$79,476	\$71,936	\$373,369	100.0%
Cost of Goods Sold	\$42,673	\$45,857	\$61,370	\$62,922	\$56,809	\$269,629	72.2%
Net Income	\$3,506	\$5,059	\$5,767	-\$313	\$3,004	\$17,023	4.6%
Basic Research	\$761	\$827	\$1,079	\$1,501	\$543	\$4,711	1.3%
Applied Research	\$3,266	\$3,918	\$4,145	\$4,571	\$4,234	\$20,134	5.4%
Capital Expenditures	\$1,262	\$1,204	\$2,037	\$2,307	\$2,312	\$9,121	2.4%
TOTAL DEFENSE CONTRACTORS							
Net Sales	\$59,027	\$65,330	\$65,649	\$68,129	\$40,649	\$298,784	100.0%
Cost of Goods Sold	\$31,158	\$34,508	\$36,631	\$41,961	\$34,277	\$178,534	59.8%
Net Income	\$2,815	\$3,348	\$2,528	\$1,534	\$968	\$11,193	3.7%
Basic Research	\$1,432	\$1,604	\$2,091	\$2,493	\$951	\$8,570	2.9%
Applied Research	\$1,422	\$1,463	\$2,241	\$2,301	\$1,558	\$8,986	3.0%
Capital Expenditures	\$2,158	\$2,389	\$4,530	\$4,950	\$963	\$14,991	5.0%
SPECIAL CATEGORY							
Net Sales	\$46,851	\$44,368	\$45,407	\$47,370	\$52,588	\$236,585	100.0%
Cost of Goods Sold	\$33,484	\$33,795	\$34,082	\$35,944	\$39,921	\$177,225	74.9%
Net Income	\$2,747	\$1,790	\$2,128	\$1,615	\$2,017	\$10,298	4.4%
Basic Research	\$164	\$204	\$198	\$158	\$144	\$867	0.4%
Applied Research	\$241	\$281	\$301	\$310	\$192	\$1,325	0.6%
Capital Expenditures	\$317	\$375	\$316	\$287	\$246	\$1,542	0.7%
GRAND TOTAL							
Net Sales	\$170,292	\$177,608	\$200,690	\$194,975	\$165,174	\$908,739	100.0%
Cost of Goods Sold	\$107,314	\$114,160	\$132,082	\$140,826	\$131,007	\$625,389	68.8%
Net Income	\$9,069	\$10,197	\$10,423	\$2,836	\$5,990	\$38,515	4.2%
Basic Research	\$2,357	\$2,634	\$3,367	\$4,152	\$1,638	\$14,148	1.6%
Applied Research	\$4,929	\$5,662	\$6,686	\$7,183	\$5,984	\$30,445	3.4%
Capital Expenditures	\$3,737	\$3,968	\$6,883	\$7,545	\$3,520	\$25,654	2.8%

*Estimated from projections by respondents

The cost of goods sold refers to the direct costs of producing goods sold. Direct costs include purchase of raw materials, energy, and direct labor. Generally, relatively lower levels of the cost of goods sold are related to lower volume, labor intensive, non-standard production industries that drive higher such indirect costs as administration, selling, certain rentals, physical plant and other fixed costs. For the survey respondent group, the cost of goods sold averaged 69 percent of net sales. It was highest for the special category at 75 percent and lowest for the defense group of contractors at 60 percent. The non-defense group was about 72 percent. The defense power electronics sector was the lowest of all at 52.6 percent, and was primarily responsible for the lower overall level attributable to the defense group. In the defense group, wireless broadband contractors registered 75 percent and advanced composites 78 percent. In the non-defense group, power electronics was the highest at 80 percent and wireless lowest at 59 percent – just opposite the defense group.

Caution is needed before assigning too much credence to these values because the sectors are actually quite diverse within themselves and we do not know how much is actually purchased by Defense. The range between individual companies can be quite broad. In addition, large companies have an undo affect on the results.

Net income (profits) averaged 4.2 percent. As a group, defense contractors averaged 3.7 percent, while profits for firms in the special category were 4.4 percent, and for non-defense contractors, 4.6 percent. In the defense group, losses were reported by the battery sector in four of the five years and one year in the wireless broadband sector. For the five years (1998-2002) defense battery contractors reported an overall loss of -2.6 percent. In the non-defense group the battery and power electronics sectors each reported losses in 1998. Wireless broadband suffered major losses in 2001 and 2002 on collapsing sales. The advanced composites sector achieved the highest return of all for the five years at 6.5 percent. The sector includes a number of plastic polymer companies, many of whom are not involved directly in advanced composites. Nevertheless, these companies may provide a future market or support on-going research in the field.

Research statistics were incomplete. A total of 297 firms provided research statistics, about 63 percent of the respondent pool (471); and most provided only partial information. Relative to the respondent pool about one-third the firms furnished data on basic research and 42 percent on applied. Only 38 firms (8%) completed the information in its entirety (i.e., five years of basic and five years of applied research). Ninety-nine companies responded by completing five years of basic research, and 142 firms completed five years of applied. An accounting by technology and defense contracting status is shown on the following table.

Tally of Survey Respondents Reporting Research Statistics						
Defense Status	Technology	Total	Basic Research	Applied Research	% Basic	% Applied
Unknown	Unspecified	7	7	3	100.0%	42.9%
Defense Contractors						
Def	Adv Comp	9	4	8	44.4%	88.9%
Def	Batteries	12	7	8	58.3%	66.7%
Def	Power El	37	18	27	48.6%	73.0%
Def	Wireless	37	23	25	62.2%	67.6%
Def	Total	95	52	68	54.7%	71.6%
Non-Defense Contractors						
Non-Def	Adv Comp	60	29	44	48.3%	73.3%
Non-Def	Batteries	16	12	6	75.0%	37.5%
Non-Def	Power El	34	14	23	41.2%	67.6%
Non-Def	Wireless	56	25	34	44.6%	60.7%
Non-Def	Total	166	80	107	48.2%	64.5%
Special Category						
Both	Special	29	13	19	44.8%	65.5%
	Total	297	152	197	51.2%	66.3%

Overall, estimated research expenditures averaged about five percent of sales during the five years 1998 to 2002. This is higher than the national average and probably indicates the presence of an emerging and highly competitive situation in these sectors, especially in the non-defense contractor sector where expenditures averaged 6.7 percent of sales.

Basic research averaged about 1.6 percent of net sales and applied, 3.4 percent. The high year was 2001, when combined basic and applied research was an estimated \$11.3 billion. The low was \$7.3 billion in 1998. The non-defense sector accounted for one-third of the basic and two-thirds of the applied research. The defense sector represented more than 60 percent of the basic research and less than 30 percent of the applied. The special category, undoubtedly understated, was only 4.9 percent of the total.

Among the defense contractor group, power electronics dominated the numbers, spending a total \$13.3 billion on research, more than three-fourths the groups total. More than half the sectors' total was basic research. Power electronics also accounted for more than 60 percent of the groups' sales. Advanced composites firms spent eight percent of sales on applied research. The non-defense group was led by wireless broadband companies, which logged about \$17 billion in research expenditures, two-thirds of the groups' total. Applied research, at \$14.8 billion, represented nearly 13 percent of the wireless sector's sales.

Capital expenditures averaged 2.8 percent of sales and totaled \$25.7 billion for the five years. The defense group accounted for nearly 60 percent of the total and the non-defense group,

most of the remainder. The special category was understated. As with research, power electronics again dominated the defense group and wireless broadband the non-defense group.

The details for each technology are shown on the following two tables – the first for non-defense contractors and the second for defense contractors.

NON-DEFENSE CONTRACTORS							
Estimated Financial Indicators for Four Technologies							
(in \$millions)							
Financial Measure	1998	1999	2000	2001*	2002*	5-yr Total	5-yr Ratios
ADVANCED COMPOSITES							
Net Sales	\$10,924	\$11,532	\$12,869	\$12,254	\$12,504	\$60,084	100.0%
Cost of Goods	\$8,229	\$8,651	\$9,891	\$10,533	\$9,642	\$46,946	78.1%
Net Profit	\$957	\$899	\$905	\$600	\$544	\$3,905	6.5%
Basic Research	\$40	\$43	\$50	\$43	\$47	\$223	0.4%
Applied Research	\$688	\$908	\$627	\$562	\$678	\$3,463	5.8%
Capital Expenditures	\$181	\$200	\$180	\$152	\$201	\$913	1.5%
BATTERIES							
Net Sales	\$10,944	\$16,394	\$23,479	\$20,439	\$28,151	\$99,408	100.0%
Cost of Goods	\$8,426	\$12,774	\$18,021	\$15,553	\$22,008	\$76,783	77.2%
Net Profit	-\$15	\$103	\$1,123	\$380	\$1,901	\$3,492	3.5%
Basic Research	\$35	\$21	\$41	\$33	\$59	\$189	0.2%
Applied Research	\$114	\$137	\$141	\$213	\$103	\$707	0.7%
Capital Expenditures	\$160	\$230	\$446	\$249	\$468	\$1,553	1.6%
POWER ELECTRONICS							
Net Sales	\$19,232	\$17,946	\$20,978	\$20,205	\$18,916	\$97,278	100.0%
Cost of Goods	\$13,464	\$12,685	\$16,597	\$18,112	\$16,573	\$77,431	79.6%
Net Profit	-\$130	\$1,430	\$1,233	\$452	\$1,048	\$4,033	4.1%
Basic Research	\$361	\$408	\$432	\$780	\$167	\$2,148	2.2%
Applied Research	\$237	\$227	\$250	\$210	\$205	\$1,129	1.2%
Capital Expenditures	\$96	\$88	\$122	\$113	\$84	\$504	0.5%
WIRELESS BROADBAND							
Net Sales	\$23,314	\$22,037	\$32,306	\$26,579	\$12,365	\$116,600	100.0%
Cost of Goods	\$12,553	\$11,747	\$16,861	\$18,723	\$8,586	\$68,469	58.7%
Net Profit	\$2,694	\$2,627	\$2,507	-\$1,746	-\$489	\$5,594	4.8%
Basic Research	\$325	\$355	\$556	\$645	\$271	\$2,151	1.8%
Applied Research	\$2,228	\$2,647	\$3,127	\$3,587	\$3,247	\$14,835	12.7%
Capital Expenditures	\$825	\$685	\$1,290	\$1,794	\$1,559	\$6,152	5.3%

*Estimated from projections by respondents

DEFENSE CONTRACTORS							
Estimated Financial Indicators for Four Technologies							
(in \$millions)							
Financial Measure	1998	1999	2000	2001*	2002*	5-yr Total	5-yr Ratios
ADVANCED COMPOSITES							
Net Sales	\$831	\$913	\$1,206	\$796	\$1,001	\$4,748	100.0%
Cost of Goods	\$645	\$721	\$910	\$638	\$793	\$3,706	78.1%
Net Profit	\$41	\$38	\$54	-\$34	\$8	\$108	2.3%
Basic Research	\$1	\$1	\$1	\$0	\$1	\$3	0.1%
Applied Research	\$33	\$51	\$55	\$195	\$46	\$380	8.0%
Capital Expenditures	\$52	\$15	\$27	\$31	\$29	\$153	3.2%
BATTERIES							
Net Sales	\$5,914	\$6,029	\$6,031	\$6,105	\$5,718	\$29,797	100.0%
Cost of Goods	\$3,945	\$3,938	\$3,854	\$2,665	\$4,361	\$18,762	63.0%
Net Profit	\$43	-\$106	-\$102	-\$175	-\$424	-\$763	-2.6%
Basic Research	\$45	\$48	\$43	\$43	\$47	\$226	0.8%
Applied Research	\$37	\$40	\$36	\$33	\$29	\$175	0.6%
Capital Expenditures	\$211	\$202	\$169	\$189	\$175	\$947	3.2%
POWER ELECTRONICS							
Net Sales	\$38,673	\$44,408	\$42,558	\$44,267	\$18,897	\$188,804	100.0%
Cost of Goods	\$16,350	\$20,137	\$20,545	\$25,992	\$16,310	\$99,335	52.6%
Net Profit	\$2,269	\$2,756	\$1,843	\$1,792	\$847	\$9,507	5.0%
Basic Research	\$1,214	\$1,357	\$1,835	\$2,138	\$487	\$7,030	3.7%
Applied Research	\$922	\$989	\$1,656	\$1,563	\$1,163	\$6,294	3.3%
Capital Expenditures	\$1,563	\$1,869	\$3,938	\$4,457	\$526	\$12,354	6.5%
WIRELESS BROADBAND							
Net Sales	\$13,609	\$13,979	\$15,854	\$16,962	\$15,033	\$75,436	100.0%
Cost of Goods	\$10,219	\$9,713	\$11,322	\$12,667	\$12,812	\$56,732	75.2%
Net Profit	\$462	\$659	\$732	-\$50	\$538	\$2,341	3.1%
Basic Research	\$173	\$199	\$212	\$311	\$417	\$1,311	1.7%
Applied Research	\$430	\$383	\$494	\$510	\$320	\$2,137	2.8%
Capital Expenditures	\$332	\$302	\$396	\$273	\$233	\$1,536	2.0%

*Estimated from projections by respondents

Federal contracts and grants information were incomplete and underreported. No effort was made to analyze the data except to note that companies with defense contracts provided the majority of responses, as might be expected. Very few companies reported federal grants. Statistical information was filed for the five year period. The available statistical information for 2000-2002 is presented in the table below.

Tally of Federal Contracts and Grants, 2000 to 2002							
Defense Status		Total Value (in \$000)			Firm Count		
	Technology	2000	2001	2002	2000	2001	2002
Federal Contracts							
	Batteries		\$1,300		0	1	0
	Power El	\$22,208	\$21,213	\$20,127	1	1	1
Def	Adv Comp	\$15,900	\$6,957	\$7,302	5	6	6
Def	Batteries	\$121,444	\$139,796	\$145,803	12	12	9
Def	Power El	\$6,374,679	\$8,499,672	\$6,989,828	35	34	33
Def	Wireless	\$1,622,467	\$1,703,660	\$2,084,716	22	23	16
Non-Def	Adv Comp	\$250	\$100		1	1	0
Non-Def	Power El	\$32,167	\$38,576	\$19,682	4	5	5
Non-Def	Wireless	\$2,928	\$61	\$1,421	3	1	3
Both	Special	\$4,773,931	\$4,395,280	\$4,414,244	31	31	29
	Total	\$12,965,975	\$14,806,615	\$13,683,123	114	115	102
Federal Grants							
Def	Batteries	\$1,000	\$1,500	\$1,750	1	1	1
Def	Power El	\$9,192	\$11,770	\$7,692	6	5	5
Def	Wireless	\$808	\$746	\$750	1	1	1
Non-Def	Adv Comp	\$38	\$92		1	1	0
Non-Def	Power El	\$392	\$708	\$867	1	2	2
Non-Def	Wireless		\$2,509	\$2,500	0	2	2
Both	Special	\$10	\$10	\$310	1	1	2
	Total	\$11,440	\$17,335	\$13,869	11	13	13

PART II – Database Analysis

4. Survey Review

4.1 Interpreting the Survey Responses

The survey document sought to answer questions regarding private companies' attitudes about interacting with the public sector and in some cases with other private sector firms. The responses are essentially a poll of those companies in the database. This was not a random sample. The firms were specifically targeted based on their product and technology orientation. Their response depended, at least in part, on their specific capabilities, firm size and integration, and previous government experience. For most companies, interaction with the U.S. government was limited and for most represented a small proportion of their total revenues, which were derived primarily from sales to other private companies.

More emphasis was ultimately placed on interest and interactions with the U.S. Department of Defense, although insight was also gained into relations with other federal government agencies and laboratories, a smaller market. The respondent data was separated according to the companies standing as contractors to DoD, as alluded to in the discussion above on business activities. Question number 11 on page 17 of the survey asked specifically:

“Has your Business acted as a Prime or a Sub-Contractor on a DoD contract within the past five years?”

A total of 470 companies responded to this question, including 43 firms in the special category. Of the total 470, the four technologies were represented by 427 firms, of which 158, or 37 percent answered “Yes,” we have contracted with DoD in the past five years, while 269 answered “No,” we have not. The response by technology is presented in the following table.

Status of Companies as Defense Contractors				
Technology	# Yes	# No	Total	Percent Yes
Advanced Composites	21	102	123	17.1%
Batteries	24	27	51	47.1%
Power Electronics	65	58	123	52.8%
Wireless Broadband	48	82	130	36.9%
Four-Sector Total	158	269	427	37.0%
Specials	39	4	43	90.7%
Grand Total	197	273	470	41.9%

The four technologies: advanced composites, batteries, power electronics, and wireless broadband were bundled into a single four sector total in consideration that responses as divided into defense and non-defense contractors were for the most part similar across the technologies. The detailed responses by individual technologies, including the special category, are presented in tabular form in Appendix II.

4.2 Interpreting Factor-Rating Questions.

Beginning with question 4 on page 3, 22 questions in the survey were of the statement-option type, where a statement concerning an aspect of public/private interaction is made followed by a list of factors or conditions for the respondent to evaluate. The respondent evaluated each condition by selecting one of four levels of either frequency or agreement as the case might call for, and checking the appropriate level. The method we used to measure and graph these responses applied weights to the levels. For various questions, the four options formed a frequency range: not at all, slightly, moderately, and most often; or an agreement range: disagree, slightly agree, agree, and strongly agree, depending on the question's logic. Options were weighted from 0 to 1 as follows:

not at all = 0; slightly = 1/3; moderately = 2/3; and, most often = 1.

For a specific factor, these weights would be summed and then divided by the number of respondents. The result would have a percentage value from 0 to 100. For example, assume 10 companies responded to factor A as follows: 1 = not at all, 3 = slightly, 3 = moderately, and 3 = most often. The weighted sum then equals: $[1 \times 0] + [3 \times 1/3] + [3 \times 2/3] + [3 \times 1] = 6$. Divide this by 10 (10 companies), and the answer is 0.6 or 60 percent.

Most factor-rating questions included an “Other” option where companies were given the opportunity to list and evaluate additional factors. These are added to the parent question analysis where appropriate.

4.3 Written Questions

Questions 13 on page 7, 15 on page 8, and 25 on page 11 asked the survey respondents for written comments. These are summarized in sequence in the write up that follows. In addition, an itemized list of the comments, arranged by the major issues they addressed is provided.

4.4 Yes/No Questions

Beginning with question 16 on page 8, the survey contained 21 Yes/No questions. These were evaluated based on the percent of respondents that answered “Yes”. Five of the Yes/No questions were actually a list of Yes/No options which could be graphed. Some of the Yes/No questions had qualifiers, for example, “No” or “No, but want to,” which required additional explanation.

5. Research and Development Projects

5.1 Stage R&D Communicated to the Federal Government

Question 4 on page 3 and question 5 on page 4 asked companies to identify the stage in the R&D process when they communicate R&D results to non-DoD federal agencies and labs and to DoD agencies and labs. Each question included three stages labeled A to C. A blank category labeled D was provided for companies to write-in and evaluate other stages. The four options ranged from not at all, rarely, moderately, and most often (a frequency range).

The response to question 4 regarding non-defense federal agencies was very small. Only 18 defense and 19 non-defense contractors responded, which is less than 10 percent of the companies in the database. It is difficult to make judgments based on such sparse data, except to assume that very little communication of this sort is taking place at these stages. Reinforcing this conclusion, the weighted percentages in this frequency range for each stage in the R&D process were also very low, especially basic research discovery, which is rarely undertaken by private firms. In fact, defense contractors scored only 8.3 percent in this stage. Non-defense contractors were less than 10 percent in every category.

The write-in category registered a high percentage for both contractor groups, but again, involved a very small sample size. Several companies listed patent applications, export licensing, FCC approvals, and EPA compliance as the stage in the R&D process when their communication occurred, which is not really the forms of communication and technology sharing of interest here. A few mentioned commercial dealings, such as with prime contractors and new product introductions. These, however, are not directly connected to federal government agencies. Others reported they do no R&D, or have no experience dealing with federal agencies. The following table shows the number of responses and the weighted percentage for each category.

Responses to Question 4 Page 3	Defense Contractors		Non-Defense Contractors	
4. At what stage in the R&D process does your business communicate R&D results to federal agencies and labs?	Total Responses	Percent	Total Responses	Percent
A. Basic research discovery	16	8.3%	17	2.0%
B. Proof-of-principle	17	23.5%	17	3.9%
C. Beta-level device	17	35.3%	16	8.3%
D. Write-in Categories	18	79.6%	19	73.7%

The response to question 5, communication with defense agencies and labs, was much greater, in fact more than 90 percent of the respondents in the database answered the question. However, the percentages of companies that actually communicate R&D activity were low, especially for non-defense contractors where communication approached zero percent. For example, of 243 non-defense contractors that responded to the basic research discovery stage, only three companies cited most often versus 225 that cited not at all. By comparison, of 142 DoD contractors that responded to the basic research discovery stage, 89 companies reported not at all, while just 10 reported most often.

Based on these results, relatively little R&D process communication takes place, and what does occur is concentrated among a rather small group of firms. The write-in category included product improvements on existing contracts, performance information, design verification and reliability, specifics requested at time of RFQ, and new product announcements, all generally outside the purview of the question. As in the previous question, very few companies responded to this write-in portion. The following table presents the stage of communication with DoD agencies and labs for the categories shown.

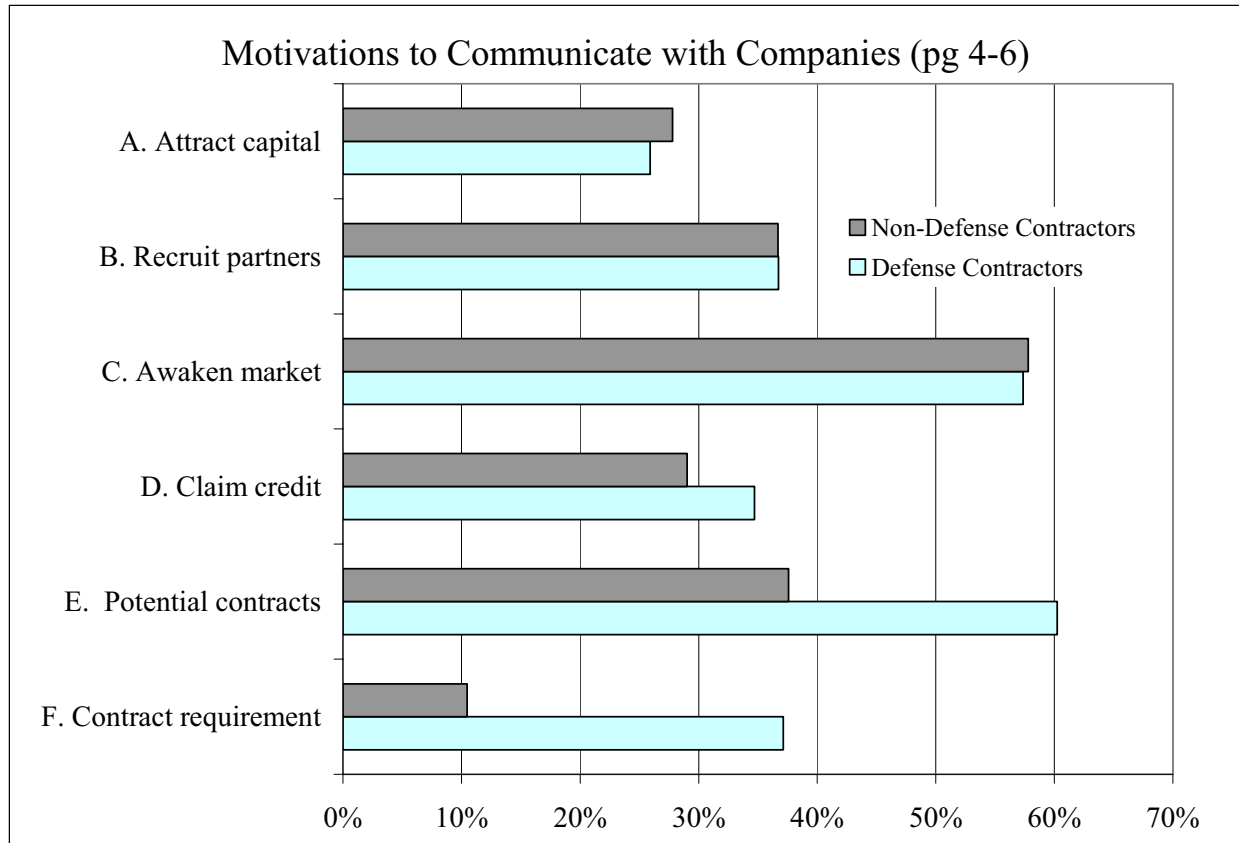
Responses to Question 5 Page 4	Defense Contractors		Non-Defense Contractors	
5. At what stage in the R&D process does your business communicate R&D results to DoD agencies and labs?	Total Responses	Percent	Total Responses	Percent
A. Basic research discovery	142	20.2%	243	3.6%
B. Proof-of-principle	145	32.4%	241	4.1%
C. Beta-level device	144	37.3%	242	4.8%
D. Write-in Categories	22	66.7%	24	19.4%

5.2 Factors that Motivate Businesses to Communicate R&D

Questions 6 and 7 on page 4, and question 8 on page 5 asked companies to identify factors that motivate them to communicate R&D programs and technology to other companies, to other federal government agencies, and to the Department of Defense, respectively. Each question included six factors, labeled A to F. A blank category labeled G was provided for companies to write-in and evaluate other motivational factors. The four options ranged from not at all, slightly, moderately, and most often.

Question 6 asked companies to weigh factors that motivate them to communicate information about their R&D programs and technology to other companies. Over 90 percent of the survey filers completed this question.

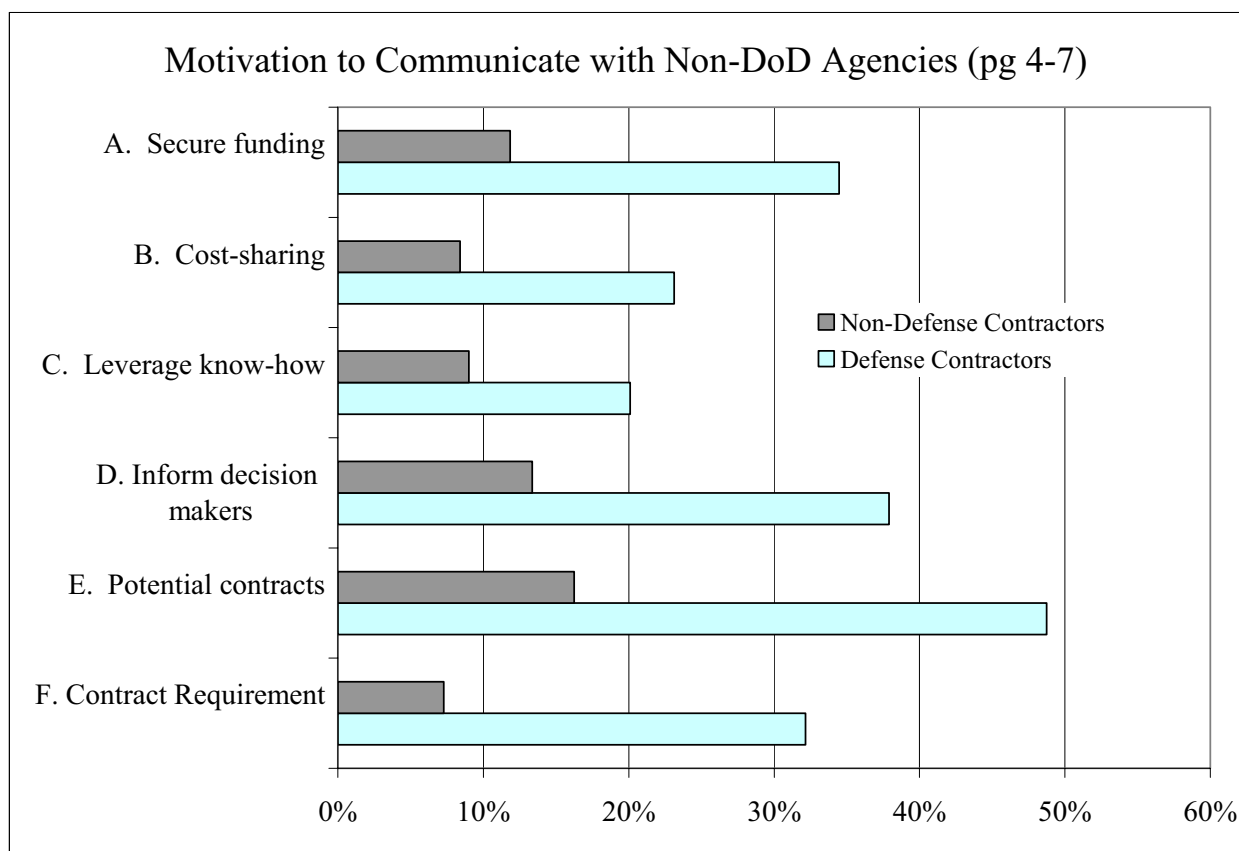
Defense contractors reported that the potential for landing contracts or grants represented their strongest motivational factor. This factor registered 60.2 percent on the frequency scale. Their desire to awaken the market and sensitize potential buyers was a close second at 57.4 percent. Non-defense contractors were motivated by a desire to awaken the market, recording 57.8 percent. All other suggested motivational factors registered less than 40 percent for both groups of contractors. Write-ins were overwhelmingly related to promoting current or future sales, or to attracting new business. A few other companies noted that collaborations with other firms, resolution of performance problems, and technical marketing were also factors. Only four defense firms and 21 non-defense contractors provided write-ins.



Question 7 asked the companies the same question regarding motivations toward communicating with non-defense federal government agencies. In this case, no factor achieved even 50 percent, which indicates generally less involvement and experience working with non-defense agencies. The potential for winning contracts or grants was 48.7 percent for defense contractors; not as strong a motivation as it was for dealing with private companies. This may be related to the smaller size of non-defense agency R&D budgets as well as their focus on other technologies than those under review. All other factors registered a frequency of less than 40 percent. Noteworthy is the low rating of 20.1 percent tallied for leveraging federal lab know-how, and 23.1 percent for collaborating with federal labs on a cost sharing basis. Non-defense contractors showed little interest. In fact, the high percent rating was only 16.3 percent, and three of six ratings registered less than 10 percent. This low rating may at least in part be related to ignorance, as opposed to actual company intent. Their lowest motivational rating was only 7.3 percent for collaborating with federal labs on a cost sharing basis. In this instance, 205 of 239 responses were not at all, or nearly 86 percent of the companies; only four companies checked most often.

Only 21 write-ins were submitted. These included patents, export licensing, and EPA compliance. These are regulatory compliance instances, which impose costs on companies faster than benefits, and may influence the perception some companies have of the government. Overall, defense contractors registered about three times (32 percent) the motivational percentage of non-defense contractors (11 percent).

The very low percentage recorded for non-defense contractors points to a general lack of experience and (we assume) more frequent support role many of them play as sub-contractors to larger firms. The following chart shows the motivational factors companies reported for non-defense federal agencies and labs.



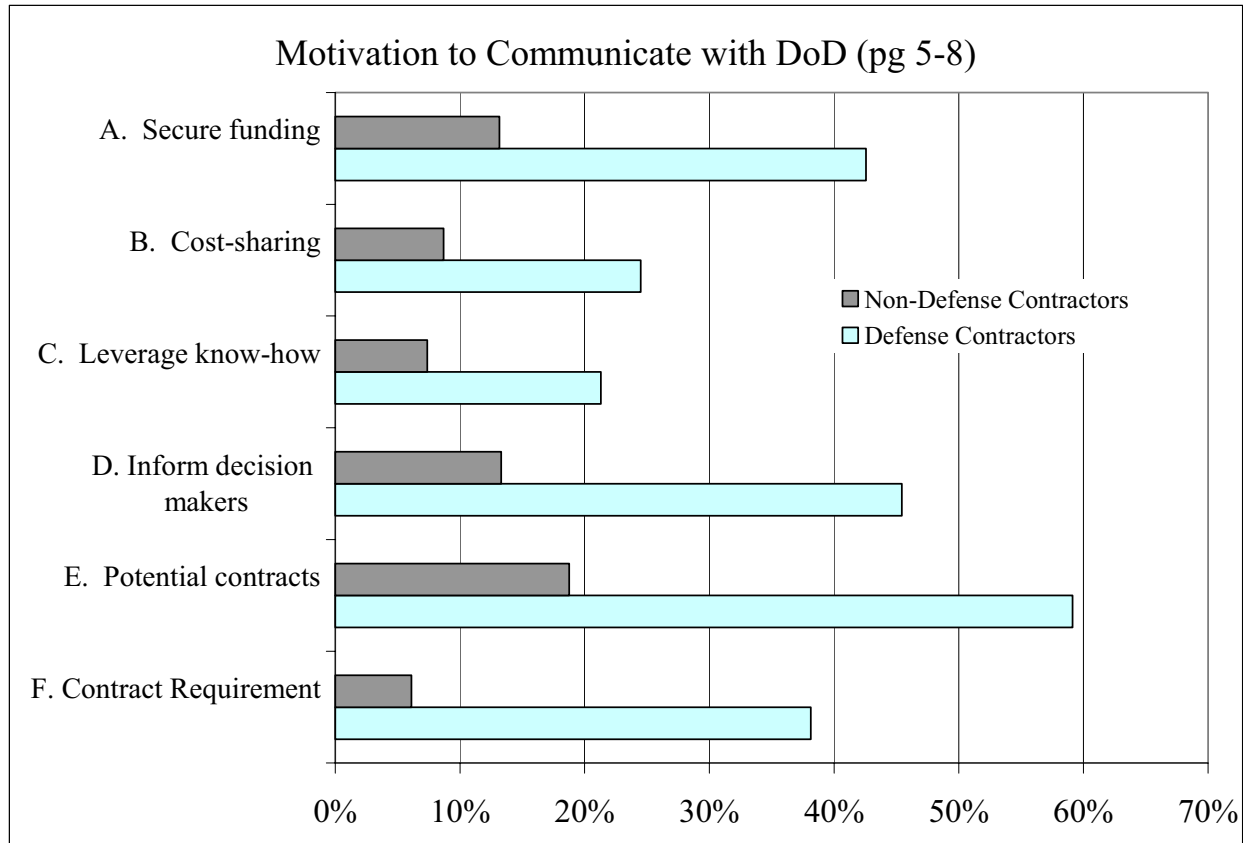
Question 8 recorded motivations of companies to communicate their R&D programs to the Department of Defense. Well over 90 percent of the companies responded to this question. defense contractors rated each of the seven listed factors at higher percentages than they had for non-defense federal government agencies, although the overall percentage of all ratings combined was still rather low at 38.6 percent. The motivational profiles were otherwise very similar. The potential for winning contracts or grants was 59.1 percent. However, only two

other factors were over 40 percent; these were efforts to make key DoD decision makers aware, 45.4 percent, and to secure government funding, 42.6 percent.

Non-defense contractors registered much lower results, as they had with non-Defense agencies. The profiles were very similar. Three factors were below 10 percent, while the high was only 18.8 percent. More than 81 percent of their overall responses were not at all. These results indicate most of the non-defense contractors were unfamiliar and lacked experience with the Department of Defense, and again apparently supports the presumption of some companies in their role as vendors to primes.

Only 17 companies submitted write-ins and only four of these were defense contractors. These companies cited lack of experience, lack of knowledge, and no R&D. One firm cited a joint venture in which contracts and grants are sought.

The following graph displays the motivations that company respondents reported influence communicating R&D programs to the Department of Defense. Note the similar profile, but difference in magnitude between defense and non-defense contractors.



5.3 Methods Businesses Use to Inform Others about R&D and Technology

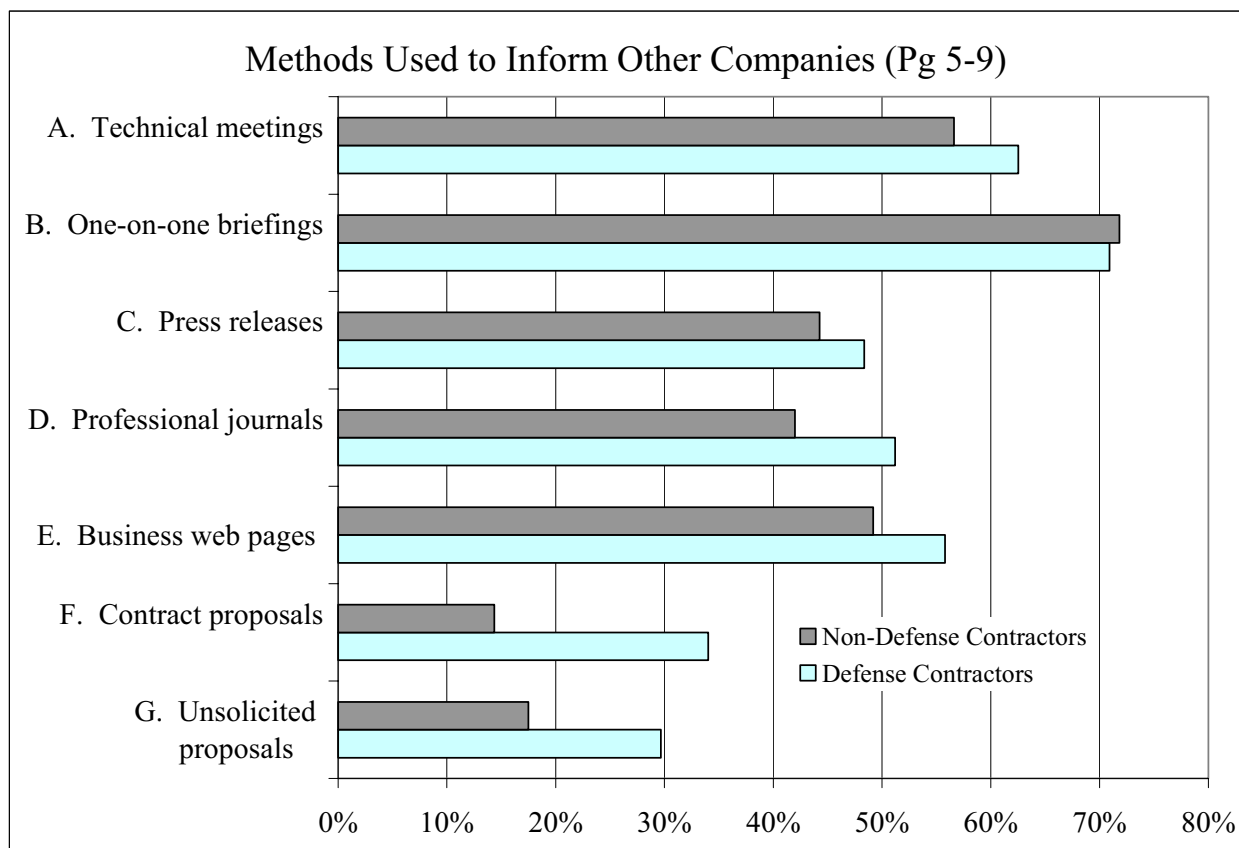
Question 9 on page 5, and questions 10 and 11 on page 6 asked companies to identify methods used to inform private companies, non-defense federal agencies and labs, and Defense agencies and labs of their R&D activities and technologies. Each question contained seven methods labeled A to G. A blank category labeled H was provided for companies to write-in and evaluate other methods. The four options ranged from not at all, rarely, moderately, and most often.

Question 9 asked the companies how they inform other private companies about their R&D and technology activities. The most common method for both defense and non-defense contractors was one-on-one briefings, which was over 70 percent in both cases. Other significant methods included presentations at technical meetings and business web pages. The former method was 62.5 percent for DoD contractors, and 56.6 percent for non-DoD contractors, while the latter method was 55.8 percent and 49.2 percent, respectively. Defense contractors scored fairly high in articles in professional journals (51.2 percent) and in press releases (48.4 percent). Overall,

DoD contractors averaged 50.4 percent for all methods compared to 42.4 percent for non-DoD contractors.

Defense contractors appear to be more proactive than non-DoD contractors and more likely to exploit opportunities in the federal government marketplace and at the margin, the commercial marketplace. This may be because they tend to be larger, more experienced and have resources dedicated to do so, which seems to be a common theme in many other areas of the survey. More than one-third of the non-DoD respondents reported not at all, compared to one-fifth of the DoD contractors. This indicates, among other things, that fewer of the non-DoD contractors have R&D programs.

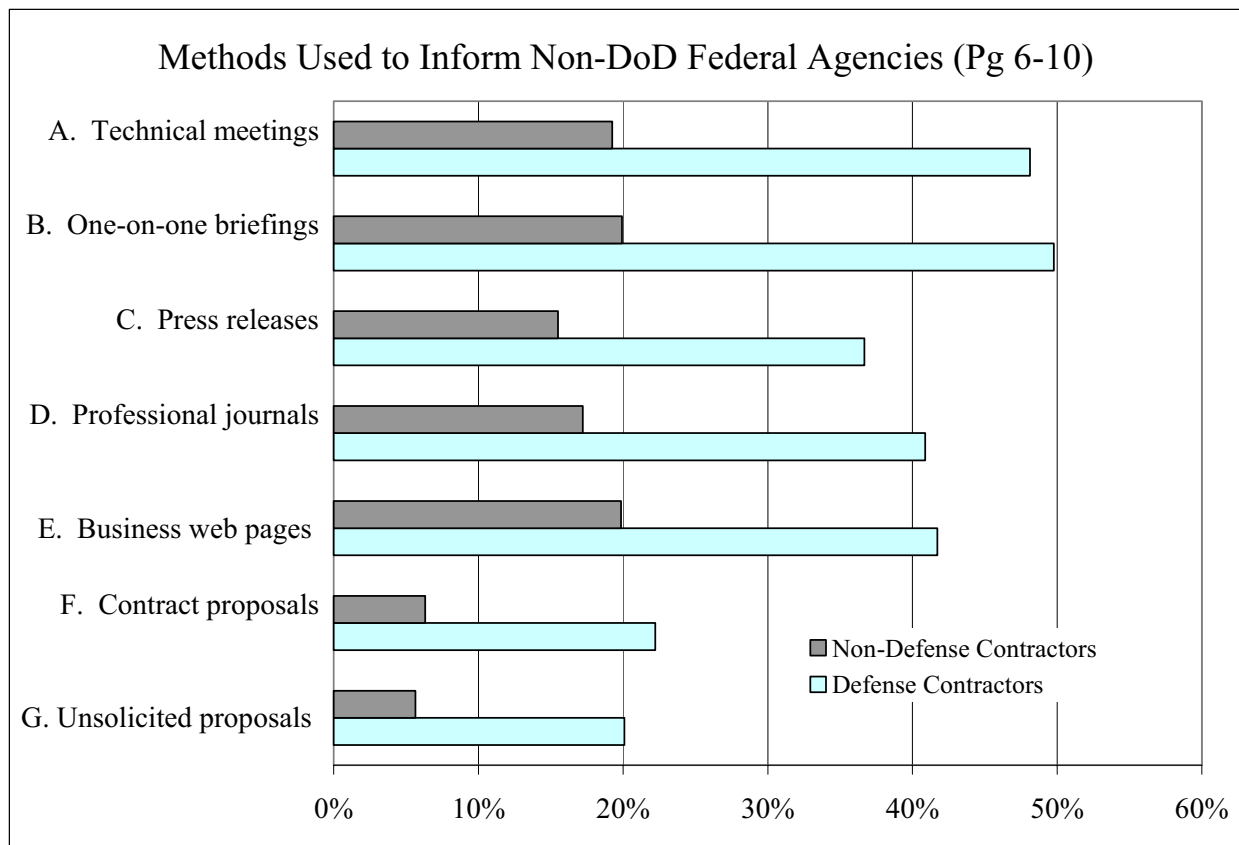
Only 15 respondents provided write-ins. Some of these overlapped with the given methods. However, one firm mentioned using direct mail and another mentioned brochures to inform other companies. The following chart presents the preference among survey respondents for various methods to inform other private companies of their R&D activity and technology.



Question 10 asked businesses to evaluate methods used to inform non-defense federal government agencies and labs of R&D activities and technologies. In overall average, defense contractors faded to only 37.2 percent for informing non-DoD federal agencies and labs compared to over 50 percent for informing private companies. Non-defense contractors faded even more to only 15 percent compared to 42 percent for informing private companies. This reflects a sharp rise in not at all reporting and is another clear indication of fewer opportunities available for these technologies in the non-defense federal sector, particularly for the technologies under review.

Defense contractors that responded by checking the not at all option rose from 21 to 39 percent, while non-defense contractors rose from 34 to more than 73 percent. The highest percentage values recorded by defense contractors include one-on-one briefings at 49.8 percent and presentations at technical meetings at 48.1 percent. The factor profile was very similar to that of private company methods, while the magnitudes were greatly reduced. Companies with defense business are more likely to also have business with non-defense federal agencies.

Twenty-two firms submitted write-ins, including six defense contractors. Companies reported patent applications, filings with the FCC, and export compliance. Still others indicated they use direct mail, fax, or email. The following chart summarizes the responses to methods used to inform non-defense federal government agencies and labs of R&D activity and technology.

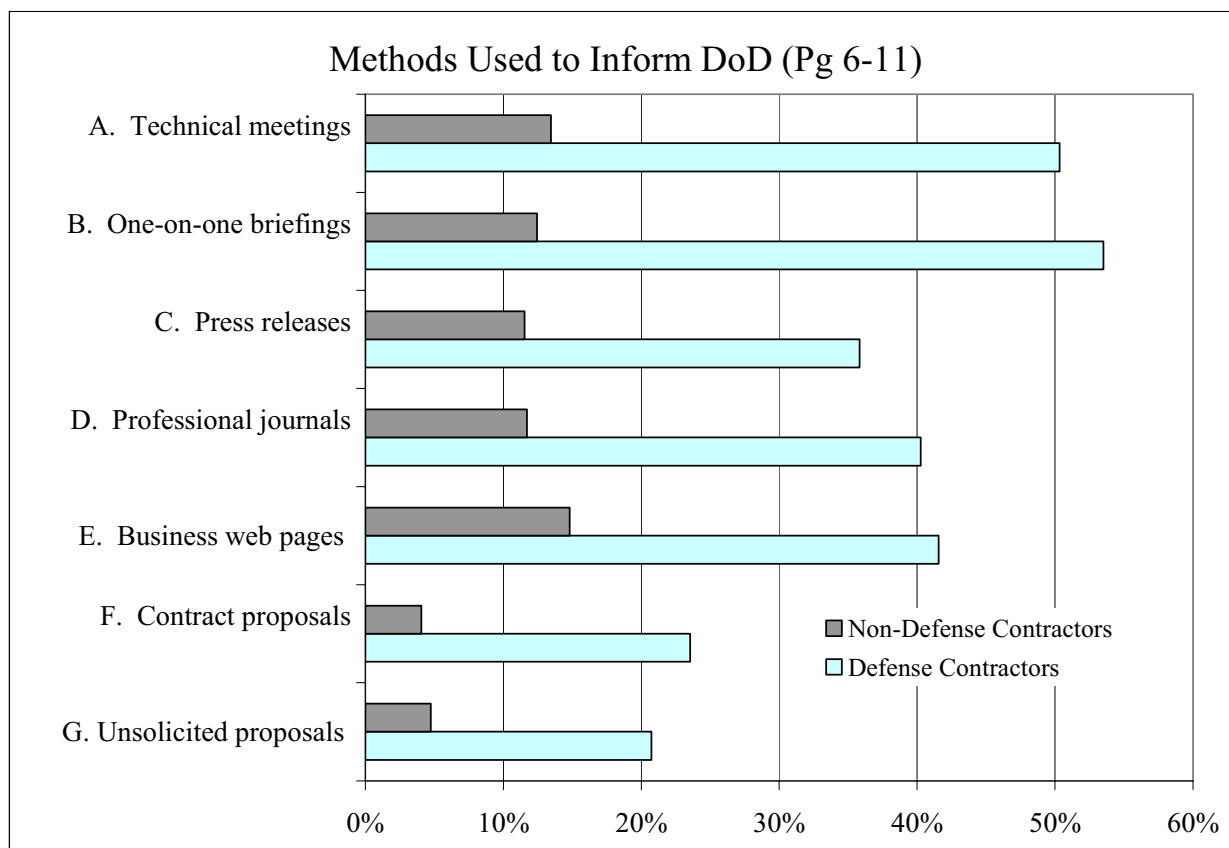


Question 11 addresses methods used by businesses to inform the Defense Department of their R&D activities and technologies. Defense contractors reported one-on-one briefings and presentations at technical meetings as both over 50 percent. Two other methods, business web pages and articles in professional journals were over 40 percent. Again, the method profile mimicked the profiles seen for other companies in question 9 and other federal agencies in question 10. In fact, the profile was almost the same as that of non-defense federal agencies. The overall method to inform average was 37.6 for defense versus 38.5 for other federal agencies. Non-DoD contractors methods were all lower than 15 percent, and taken all together, averaged only 10 percent. Based on magnitudes, the variations appear somewhat correlated to public versus private market size, especially for non-defense contractors. Here, the commercial sector far outstrips the federal government sector.

Over 81.2 percent of the non-DoD contractors checked not at all; and only 3.1 percent checked most often. Very little communication appears to take place, reaffirming the conclusion that the great majority of non-defense contractors are not familiar and inexperienced in dealing with the federal government. Only 16 companies provided write-ins. These were mostly the same companies responding to question 10 with the same comments.

Companies cited patent applications, filings with the FCC, and export compliance, and others said they use direct mail, fax, or email.

The following chart profiles the methods used to inform Defense Department agencies and labs of private R&D activities and technology.



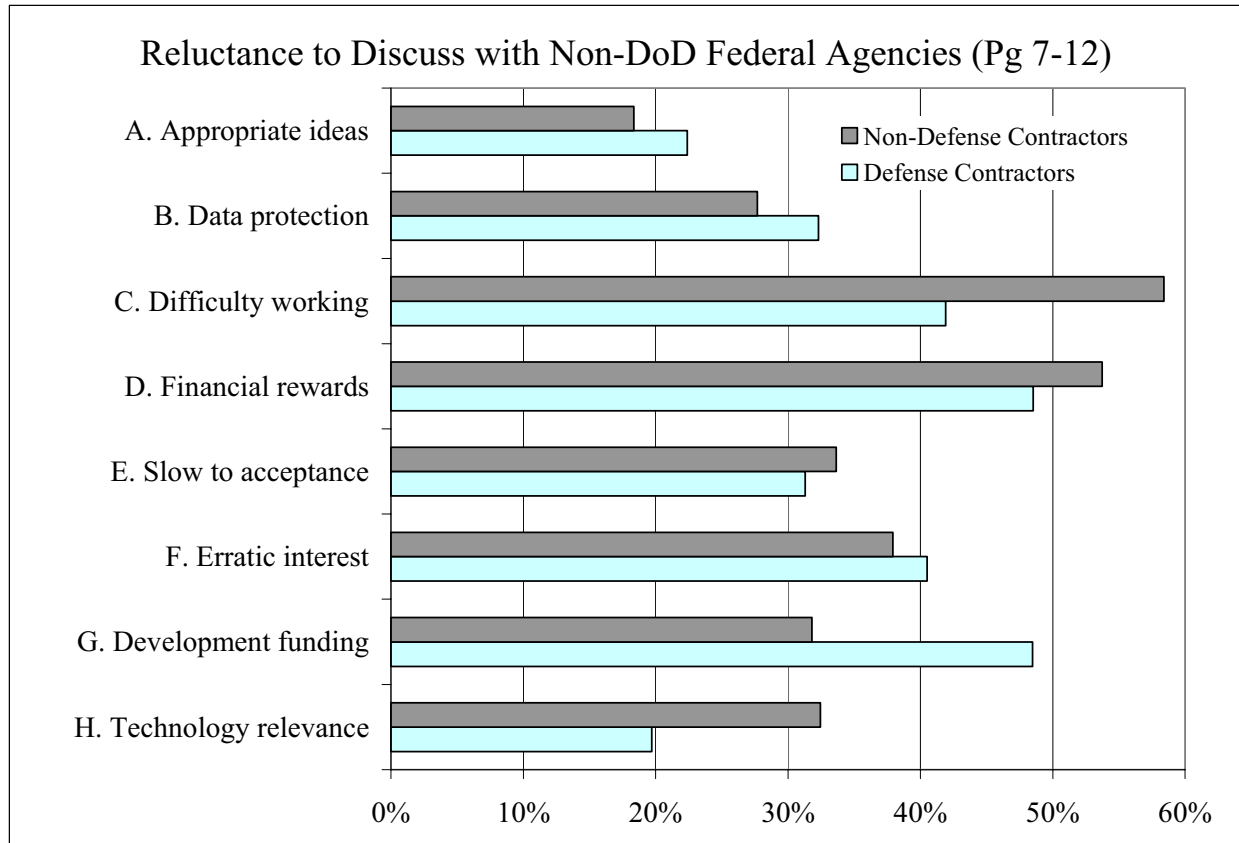
5.4 Reluctance to Discuss R&D and Technology with non-Defense Federal Agencies

Question 12 and 14 on page 7 asked companies to identify the causes for their reluctance to discuss R&D programs and new technologies with federal agencies and labs. Each question offered eight possible reasons labeled A to H. A blank category labeled I was provided for companies to write-in and evaluate other reasons. The four options ranged from disagree, slightly agree, agree, and strongly agree. Companies willing to discuss their work were requested not to complete these questions.

Question 12 asked firms why they were reluctant to discuss R&D programs and new technologies with non-defense federal agencies and labs. A total of 68 defense contractors and 117 non-defense contractors responded to question 12, which equates to about 43 percent of all firms in each category. This can be interpreted to mean about 57 percent of the firms would be willing to discuss their operations.

In percent, defense contractors ranked below 50 percent in all eight instances, which implies the absence of a strong or consistent cause for reluctance. The high of 48.5 percent was recorded for both working with federal agencies is too difficult and the absence of federal funds for development. The low value, i.e., where the most disagreed with the premise, was that their R&D was not applicable to non-DoD uses. In fact, two-thirds of the 66 respondents to this reason disagreed with its premise. As for non-DoD contractors, the most cited cause of their reluctance to discuss their technology was working with federal agencies is too difficult (58.4 percent). A close second was financial rewards are inadequate (53.7 percent). The low at 18.3 percent was that federal researchers appropriate my company's ideas.

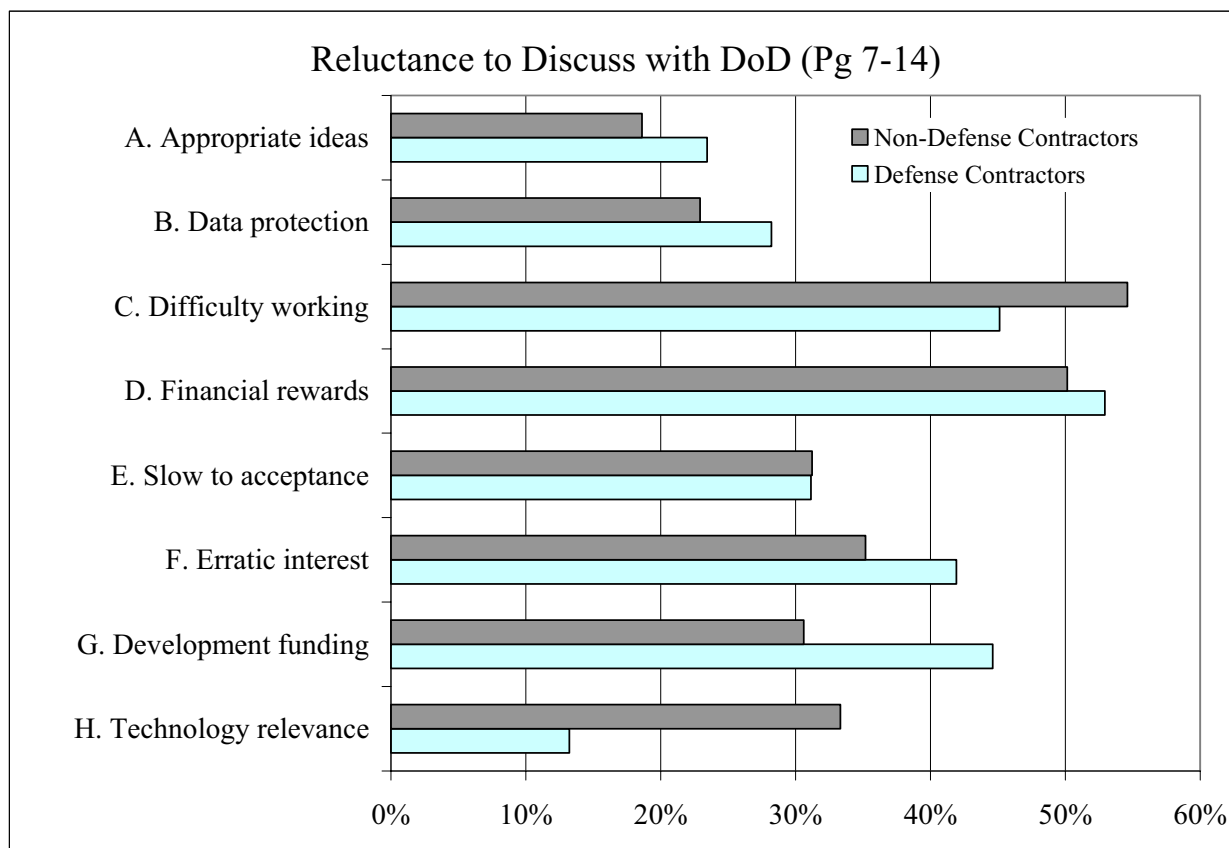
Write-ins numbered only 20, of which four were defense contractors. Additional reasons given included; due to no R&D, lack of experience, and lack of awareness. Other firms cited government accounting rules and government reluctance to use commercial practices and contracts both of which could also be considered as working with federal agencies too difficult. One firm noted its strong focus on consumer markets left federal agency contract work unimportant. The following chart presents a profile of the causes for some companies reluctance to discuss their R&D programs and new technologies with non-defense federal agencies.



Question 14 asked firms why they were reluctant to discuss R&D programs and new technologies with Defense agencies and labs. A total of 68 defense contractors and 121 non-defense contractors responded to question 14, which equates to about 43 percent of all defense contractors and 45 percent of non-defense contractors. This can be interpreted to mean that between 55 to 57 percent of the firms were willing to discuss their operations.

The strongest response cited by DoD contractors was financial rewards are inadequate (52.9 percent). All other reasons were below 50 percent. Three of the eight, however, were in the 40 to 50 percent range, while the other four were less than 40 percent. The low value was commercial technology not useful to DoD at only 13.2 percent. Non-DoD contractors registered two categories more than 50 percent, working with DoD is too difficult (54.6 percent) and financial rewards are inadequate (50.1 percent). The low for non-DoD contractors was DoD researchers appropriate my company's ideas, which matched their low for non-DoD federal agencies. Overall, the magnitudes were roughly the same, although individual factors differed. Profiles of both defense and non-defense contractors were closely aligned to non-DoD agencies.

Write-ins were submitted by 20 firms, mostly the same companies commenting on non-defense federal agencies. One comment by a foreign-owned company pointed to its headquarter country (Japan) as imposing policy limitations on U.S. defense work. The following chart profiles the reasons companies are reluctant to discuss R&D programs with Defense agencies and labs.



5.5 Why Companies were Reluctant to Discuss R&D

Companies reluctant to discuss their R&D programs with the federal government were asked to submit written comments by question 13 on page 7 and question 15 on page 8 of how to reduce or eliminate their concerns. Question 13 was directed toward non-defense agencies, and question 15 toward defense agencies. Our review of these submissions found substantial overlap. Responses were combined and duplicate comments removed.

Some companies submitted multiple comments, which could be parceled into two or three different issue categories. This resulted in more comments than companies. Thus, 53 defense

contractors submitted 76 comments and 71 non-defense contractors submitted 103 comments. The comments were placed into six issue categories as shown on the following table.

8-13/5 Reluctance to Discuss R&D and Technology with the Federal Agencies						
	Defense Contractors		Non-Defense Contractors		Combined Total	
Major Issues	Cites	Percent	Cites	Percent	Cites	Percent
Procurement Complexity	32	60.4%	25	35.2%	56	45.2%
Financial Incentives	18	34.0%	14	19.7%	33	26.6%
Communications	5	9.4%	27	38.0%	32	25.8%
Intellectual Property	12	22.6%	12	16.9%	24	19.4%
Product Irrelevance	4	7.5%	15	21.1%	19	15.3%
Small Business	5	9.4%	10	14.1%	15	12.1%
Total Companies	53		71		124	

The table displays the issue categories in descending order of the combined total of both types of contractors, showing procurement complexity and financial incentives as the central issues. Substantial differences in the relative weights, however, occur between defense and non-defense contractors for each issue, except perhaps for intellectual property or small business where the differences are their narrowest. The largest difference is communications. Here, only 9.4 percent of defense contractors considered communication a hindrance to discussing their R&D and technology with the federal government. However, 38 percent of Non-defense contractors saw this as a problem. With them it ranked their number one issue. The runner-up was procurement complexity, mentioned by 35.2 percent of the companies.

What follows is an itemized list of the company comments by basic issues for each group of contractors.

5.5.1 Procurement Complexity

Defense Contractors (cited by 32 of 53):

1. Be more responsive to industry input in the program development stage. Set more realistic goals, targets. Don't "pick our brains" with modest phase one projects and not through good later phases.
2. Deal on commercial basis.
3. DoD could embrace more commercial standards
4. Eliminate cost share requirements for non-procurement (other transactions) activity. Improve long range budget planning.

5. Eliminate federal procurement laws and allow agencies to purchase commercial products.
6. Eliminate government agency competition with industry
7. Eliminate Mil. Specs which are difficult to understand.
8. DD-250 and other "Forms" are cumbersome and require special training to complete.
9. Favored contractor status for R&D
10. For new and high risk technologies remove the restriction(s) to manufacture in the United States. Actively support the DoD developments to have commercial impact.
11. Fund development work without requiring government ownership to data.
12. Don't have individuals with conflict of interest managing funded development.
13. Get the DOE labs out of space.
14. Government procedures and requirements should not increase manufacturing costs.
15. Increase speed of bringing contracts to fruition.
16. Increased collaboration of various sub-contractors on major programs for DoD
17. Less bureaucracy
18. More government to industry contacts
19. Provide a "Quit Claim" agreement for a period of time on a technology area under development.
20. Question the infrastructure built around existing technologies. Incentives given to labs/agency that field new technology.
21. Reduce the amount of paperwork/red tape - it costs more to document the product process than they are worth.
22. Shorten sales cycle - our company has been working with one DoD agency for over two years to license software for a large deployment.
23. Streamline procurement process; greater flexibility in negotiating individual intellectual property rights.
24. There are so many concerns; we would recommend working with the Integrated Defense Commercial Company (IDCC) to commercialize government procurement.
25. Simplify contracts.
26. Have contracts that are clear and easy to understand by both parties.
27. Eliminate requirements for products to be on a GSA schedule.
28. Non-DoD federal labs need to be more willing to allow companies to retain rights to work done on a cost share basis.
29. Simplify contracts and provide sourcing status with R&D partners.
30. Do not use Commerce Business Daily or Statement of Work type procurement notices when commercial products are being sought.
31. Where appropriate move technology into operation quickly.
32. We are not reluctant based on any of the issues above. If there is any hesitancy, it is due to typical government agency desire to fund very long range technologies that do not have nearer term commercial potential.

Non-Defense contractors (cited by 25 of 71):

1. Reduce bureaucracy with contracts. Reduce reliance on government accounting standards because they do not always fit business standards. Improve negatives outlined in Question 30 on page 13.
2. A more open mind-set in federally funded research and development labs would be welcome.
3. Allow sole source when it is "best in breed."
4. De-bureaucratization; opportunity for exclusivity, no bidding plus ability to retain ownership of technology.
5. DoD research procurement process heavily favors established contractors. Encourage new contractors to participate in DoD R&D by lowering barriers to entry.
6. Eliminate bureaucracy by empowering just two technical representatives.
7. Government agencies do not have appropriate sense of urgency and speed to market for potentially commercial ventures.
8. Have a government liaison that is committed to obtaining and acting on the information presented.
9. Have government utilize commercial planning, management, and contracts. This is permitted by national policy and law (e.g., Commercial Space Act of 1998 P.L. 105-303), but is widely ignored and inconsistently used.
10. Improve timing of paperwork and payments
11. Let businesses develop technology, but not burn time documenting and accounting.
12. Make government contract process less demanding on possible strategic partners (develop strategic partner relationships with innovative companies).
13. Modifications to procurement law that mirror commercial law, especially protection of technical data and intellectual property
14. Multi-year programs- consistent funding, more favorable T's and C's, W.R.T. Patents, I/P ownership and use.
15. Purchase product directly from my company under standard commercial business practices.
16. Reduce difficulty in getting funding and better notification of potential business.
17. Reduce paperwork, tracking, office management. Be very sensitive to our need for commercial profit and return. Too many restrictions on how to spend funds.
18. Simplify contracts.
19. Simplify federal Acquisition Regulations and Accounting Regulations.
20. Creation of cross-agency forums
21. Reduce the difficulty in working with agencies and soliciting development funds.
22. Reduce paperwork and improve decision period process for doing or not doing the work.
23. Run the government like a business.
24. More communication at the start of projects. Dedicated resources to the project. Cost estimates during time lined events.
25. Reduce or eliminate the cost of doing business (i.e., the bureaucracy).

5.5.2 Financial Incentives

Defense Contractors (cited by 18 of 53):

1. Budget and program stability is an issue inhibiting our ability to work with government agencies.
2. DoD seems to have a difficult time actually receiving the funds they expect for given areas of R&D.
3. Expanded use of funded Broad Area announcement opportunities; profit incentives for unique technology
4. Make more R&D funds available.
5. More funding by DoD
6. More funding directed to go outside government agencies
7. Non-DoD agencies should have more funds (discretionary) to investigate and follow through. Discuss and have funds available to act on new things.
8. Pricing based on quality, delivery, service
9. Provide adequate funding on a timely basis.
10. Provide financial incentive for sharing of data
11. Provide funding
12. Provide greater financial rewards for acceptable R&D technologies
13. Provide R&D subsidies on tax credits for companies whose R&D efforts result in international sales thus generating income for the U.S. Government, i.e., like Canada!
14. Profit sharing incentives to increase financial rewards; higher assurance of funding.
15. Money made available for advancements in mature technologies
16. We would consider an R&D relationship if there was enough money guaranteed.
17. Incentive for operation/fielding on new technology
18. Do not usually see direct benefit in end product sales potential in near term. ROI is not early enough to be of interest.

Non-Defense Contractors (cited by 14 of 71):

1. A clear path to substantial return on investment for the company.
2. A priority business opportunity with a government agency. This could include funding which assisted the commercial business.
3. Be very sensitive to our need for commercial profit and return. Too many restrictions on how to spend funds.
4. Clear financial benefits for participating; simplify process.
5. Commercial incentives and TAX incentives.
6. Demonstrate financial rewards; publicize a process for working with agencies

7. More favorable terms and conditions, W.R.T. Patents, intellectual property ownership and use.
8. Permit greater company profit.
9. Reduce difficulty in getting funding.
10. Reduce or eliminate the cost of doing business (i.e., the bureaucracy).
11. Increase funding for applied research, including manufacturing readiness, in wireless electronic components for non-DoD applications.
12. Improve timing of paperwork and payments.
13. Make it financially feasible to develop the products.
14. Reduce the difficulty in working with agencies and soliciting development funds.

5.5.3 Communication

Defense Contractors (cited by 5 of 53):

1. Be forward with the long term intent of the program and how many suppliers will be involved.
2. Communicate needs more effectively.
3. Make more information available, re available funds.
4. My company needs to know what agencies; which contacts; and, what kind of work.
5. Publication and communication of government needs and technical interests.

Non-defense Contractors (cited by 27 of 71):

1. Adequate information and communication training for improved understanding.
2. Awareness of DoD groups/needs/activities.
3. Better educate private industry on how government agencies conduct R&D programs and handle propriety data.
4. Better identify funds available for specific research.
5. Better notification of potential business.
6. Channel to access needs to be well understood.
7. Increase interaction with these agencies and increase visibility of the programs.
8. Know more about the type of programs for which there is interest.
9. More mutual communication
10. Need to better understand opportunity.
11. Our company has little or no experience in this area.
12. Publicize a process for working with agencies.
13. Send information about DoD labs, research programs, potential R&D funding and potential contracts. My company will review and determine if further communication/collaboration is appropriate.

14. Show me a revenue opportunity.
15. We are not aware of DoD's R&D needs and hence we have not participated.
16. We are not equipped or experienced to make any suggestions.
17. We have no experience working with DoD so we don't have enough information to evaluate above issues.
18. We need more time and money and interest to be aware of the possibilities to participate.
19. We would discuss, but we have never been asked. There is no interaction.
20. We would perform R&D on a needs basis.
21. Clearly identify process and funding.
22. Opportunity has not arisen.
23. Our company has little or no experience in this area.
24. More communication
25. We have no experience working with non-DoD government agencies. If the agencies could take the initiative to contact us and provide more information, that would be helpful for us to evaluate the feasibility.
26. Better communicate access channels.
27. We have no idea of the fit of our product or how to approach these agencies.

5.5.4 Intellectual Property

Defense Contractors (cited by 12 of 53):

1. Don't harass private companies to provide proprietary financial information that is irrelevant to the proposed development cost.
2. Good strong non-disclosure agreements
3. More protection of company proprietary technology used as a springboard to new research
4. More training of government agencies on protection of proprietary information
5. Non-Disclosure Agreements
6. Risk of inadvertent intellectual property or data loss.
7. The use of outside contractors by the government can limit discussions due to concern over leakage/disclosure of information. Put in place safeguards against leakage/disclosure of information.
8. Tougher restrictions and protection of knowledge shared with DoD
9. While we are willing to discuss R&D programs with companies and Government Agencies, we do so under the terms of a written Non-Disclosure Agreement.
10. Demonstrate that companies need not be concerned about government protection of proprietary information.
11. Stronger non-disclosure language in contracts
12. Have non-disclosure agreements that are clear and easy to understand by both parties

Non-Defense Contractors (cited by 12 of 71):

1. Clearly communicate to industry that R&D is conducted under non-disclosure. Have a well understood program to ensure government employees can not use intellectual property exposed to them during their work for the government if they transition to the private sector.
2. Confidentiality agreements, exclusivity agreements, and patent and trademark rights
3. Confidentiality agreements.
4. Higher government employee ethics, especially for government contractors.
5. Intellectual property protection
6. No problem for pre-sales evaluation, but is a concern for R&D level collaboration.
7. Protect secrets.
8. Unwilling to discuss new technologies until patent protected. Will discuss after patent approval.
9. Protection of companies intellectual property
10. Allow the company to retain proprietary data.
11. General concern about tainting of company's IP
12. Keep proprietary information protected.

5.5.5 Product Irrelevance

Defense Contractors (cited by 4 of 53):

1. Our R&D efforts are mainly with DoD prime contractors; not with DoD directly
2. Our research organization is structured solely for internal product and process development. We are not currently structured for joint development programs.
3. This is mostly not applicable since our plant operation does very little pro-active R&D. Most of our work and formulations are done based upon customer's demands and requirements.
4. My company produces revenue by producing in high volume. Government does not buy in high volume.

Non-Defense Contractors (cited by 15 of 71):

1. My firm does not generally interact with DoD and non-DoD agencies or R&D efforts because we are a supplier of RVC resins and not end-use products.
2. Change scope of products.
3. My company does not perform R&D relevant DoD agencies.
4. Most of our business has no applicability to DoD or federal agencies.
5. Our product line does not match government needs.
6. Our technology is not useful to DoD.

7. We are strictly commercial.
8. We sell industrial automation equipment and do not target government or DoD accounts.
9. We work primarily in product sectors that are not of interest to DoD.
10. We are not opposed to discussing our R&D programs with non-DoD agencies, but we are so far down the supply chain that it is typically not applicable.
11. My company does not generally interact with federal agencies or R&D efforts because we are a supplier of RVC resins and not end-use products.
12. We would have to change the scope of our products from non-technical to technical.
13. My company's R&D is not applicable to non-DoD uses.
14. In our industry we would not use government agencies to commercialize R&D.
15. Our business is a toll (service) business. We have no R&D.

5.5.6 Small Business

Non-Defense Contractors (cited by 5 of 71):

1. Make it easier for small companies to bid on technology proposal directly without going through large government system integrators.
2. Need a non-burdensome method for smaller business to pursue R&D contracts and grants.
3. Shorten sales cycle - our company has been working with one DoD agency to make it easier for small companies to bid on technology proposal directly without going through large government system integrators.
4. Substantial barriers to entry for limited available funding.
5. Government agencies favor working with "systems integrators" vs. component and material suppliers and make it difficult to apply for grants.

Non-Defense Contractors (cited by 10 of 71):

1. Communicate needs and embrace small manufacturing companies.
2. Develop a small business "fast track" process.
3. We are not opposed to discussing our R&D programs with non-DoD agencies, but we are so far down the supply chain that it is typically not applicable.
4. We do not want to enter into programs for federal agencies - do not have resources to pursue.
5. We have two people working part-time. I doubt we could handle the paperwork, even if we had ideas of interest (which we don't).
6. My business is too small to pursue true research. We develop products from existing technology.
7. Obtaining government contracts/rewards is too demanding on the resources of a small company like mine. Make process easier.

8. Develop a fast track process for smaller businesses. It appears that information from a smaller organization is not as highly regarded as information generated by a larger organization.
9. Communicate needs to small enterprises.
10. We are too small (90 people) and must focus on our business plan. Not interested in government contracts at present.

5.6 Why Working with Federal Agencies is Unattractive

Question 16 asked companies if they found interaction with non-defense federal agencies and labs unproductive. A total of 141 defense contractors and 217 non-defense contractors responded. Seventy-five of the defense contractors and 62 of the non-defense contractors responded in the affirmative, and 66 defense and 155 non-defense contractors responded in the negative as shown on the following table shows these numbers and the percent in the affirmative. Companies with negative responses were asked to complete question 17.

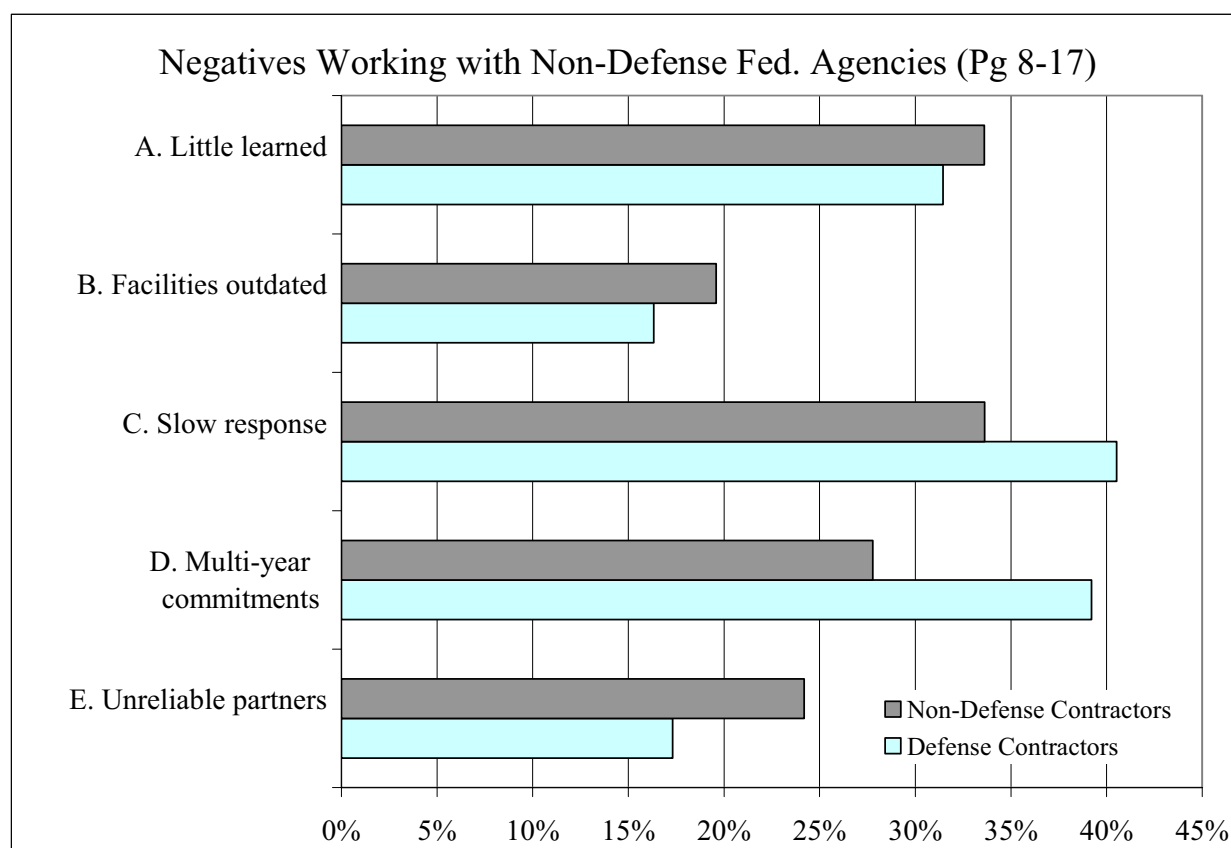
8-16. Does your business find it productive to interact with non-Defense Agencies and Laboratories in performing R&D, technology development, and engineering work in connection with developing new products?				
Respondent	Yes	No	Total Responses	Percent Yes
Defense Contractors	75	66	141	53.2%
Non-Defense Contractors	62	155	217	28.6%
All Respondents	137	221	358	38.3%

Question 17 on page 8 asked companies to identify reasons they found working with non-defense federal government agencies on R&D, technology development, and engineering in developing new products unattractive. Question 17 listed five possible reasons labeled from A to E. A blank category labeled F was provided for companies to write-in and evaluate additional reasons. The four options ranged from disagree, slightly agree, agree, and strongly agree.

Companies that responded negatively to question 16 were asked to complete question 17. However, defense contractors taken altogether scored only 33.5 percent, while non-defense contractors scored 23.7 percent in response to question 17. This is a mild response. In fact, the

highest score for any reason was only 40.5 percent recorded by defense contractors for federal researchers are slow to respond and to complete work. Non-defense contractors recorded only 33.6 percent for the same reason. A close second for defense contractors was that agencies will not make multi-year contracts (39.2 percent). Non-defense contractors also recorded 33.6 percent for little is learned interacting with federal researchers.

The write-in category included many respondents with little or no experience working with non-defense federal agencies. Some reported little relevance to their technologies. Some cited inadequate financial rewards, bureaucracy, or lack of resources. All told, a small minority of firms actually found working with non-defense federal agencies unattractive. These results are shown on the following graph.



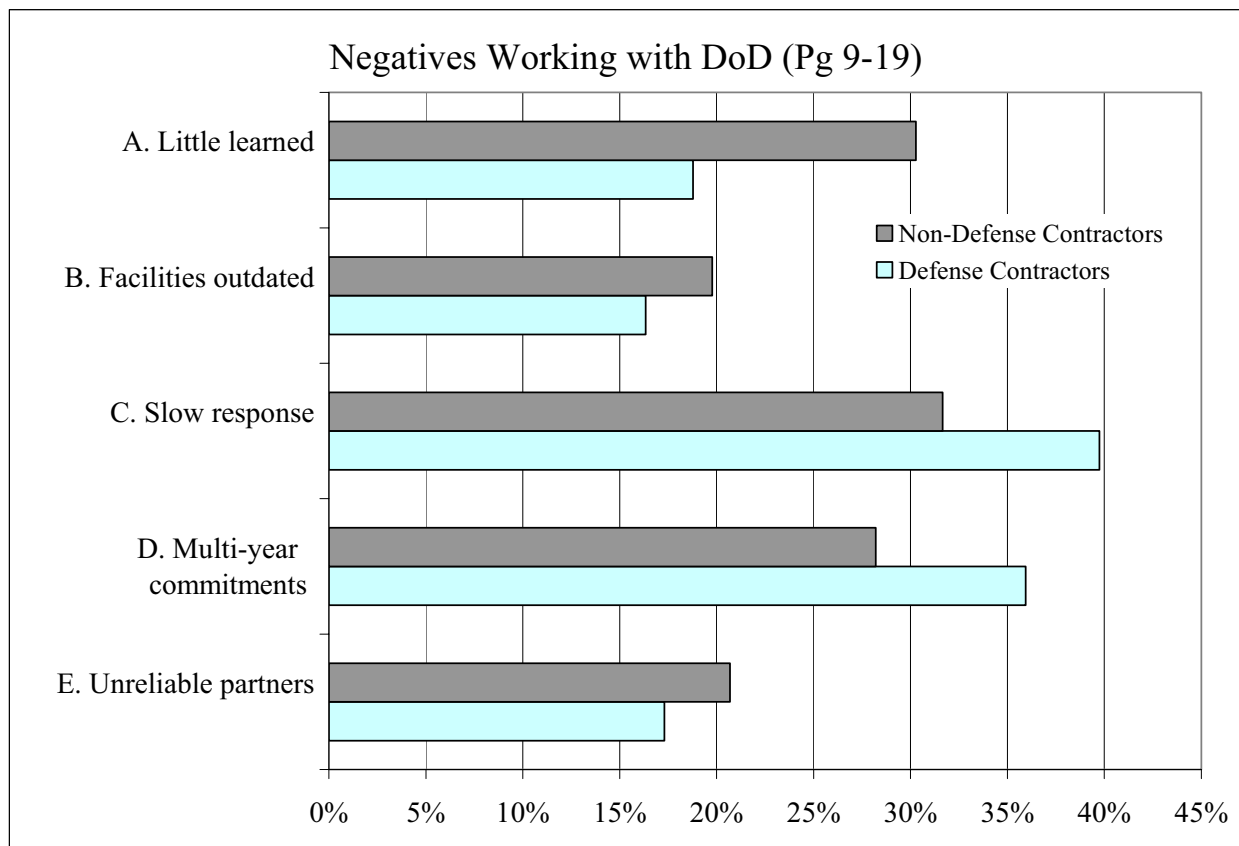
Question 18 asked companies if they found interaction with Defense agencies and labs productive. A total of 142 defense contractors and 211 non-defense contractors responded. A total of 100, or 70.4 percent of the defense contractors reported in the affirmative. However, only 23.7 percent, less than one in four of the non-defense contractors responded in the affirmative. Most of the 161 non-defense contractors that responded in the negative to this

actually had no experience working with Defense agencies, at least not in developing new products. Their response may actually mean unproductive by omission, not by commission. Compared to non-defense federal agencies, defense contractors jumped over 17 percentage points, while non-defense contractors fell by nearly five. In the case of defense contractors the difference may simply relate to the larger size of the defense market for these technologies. For non-defense contractors, the regulatory experience with EPA, NASA, or Energy may be responsible for their higher number with non-defense federal agencies. The table below shows these numbers and the percent in the affirmative.

8-18. Does your business find it productive to interact with Department of Defense federal agencies and laboratories in performing R&D, technology development, and engineering work in connection with developing new products?				
Respondent	Yes	No	Total Responses	Percent Yes
Defense Contractors	100	42	142	70.4%
Non-Defense Contractors	50	161	211	23.7%
All Respondents	150	203	353	42.5%

Question 19 on page 9 asked companies that responded negatively to question 18 to identify the reasons why they found working with Defense agencies unproductive. However, like respondents to question 17 above, defense contractors overall scored over 28.6 percent and non-defense contractors, 31.3 percent. For the five reasons, 42 defense contractors disagreed a total of 138 times compared to just 15 times for most often. The two highest values recorded by defense contractors were that federal researchers are slow to respond and to complete work (39.7 percent) and agencies will not make multi-year contracts (35.9 percent). Note that these results are about the same as tallied for non-defense federal agencies. Non-defense contractors recorded only 31.7 percent for federal researchers are slow to respond and to complete work and only 30.3 percent for little learned interacting with federal researchers. Non-defense contractors also recorded lopsided totals. In their case, 313 disagrees were recorded compared to 46 cites of most often.

Write-ins were similar to non-defense federal agencies' reports with a few exceptions. A Japanese owned firm reported the Japanese government imposes limitations on interaction with the U.S. Defense Department. Another firm cited proprietary concerns and another compliance and audit issues. Many of the comments mirrored those of previous questions 13 and 15. The following chart profiles the companies' response to question 19.



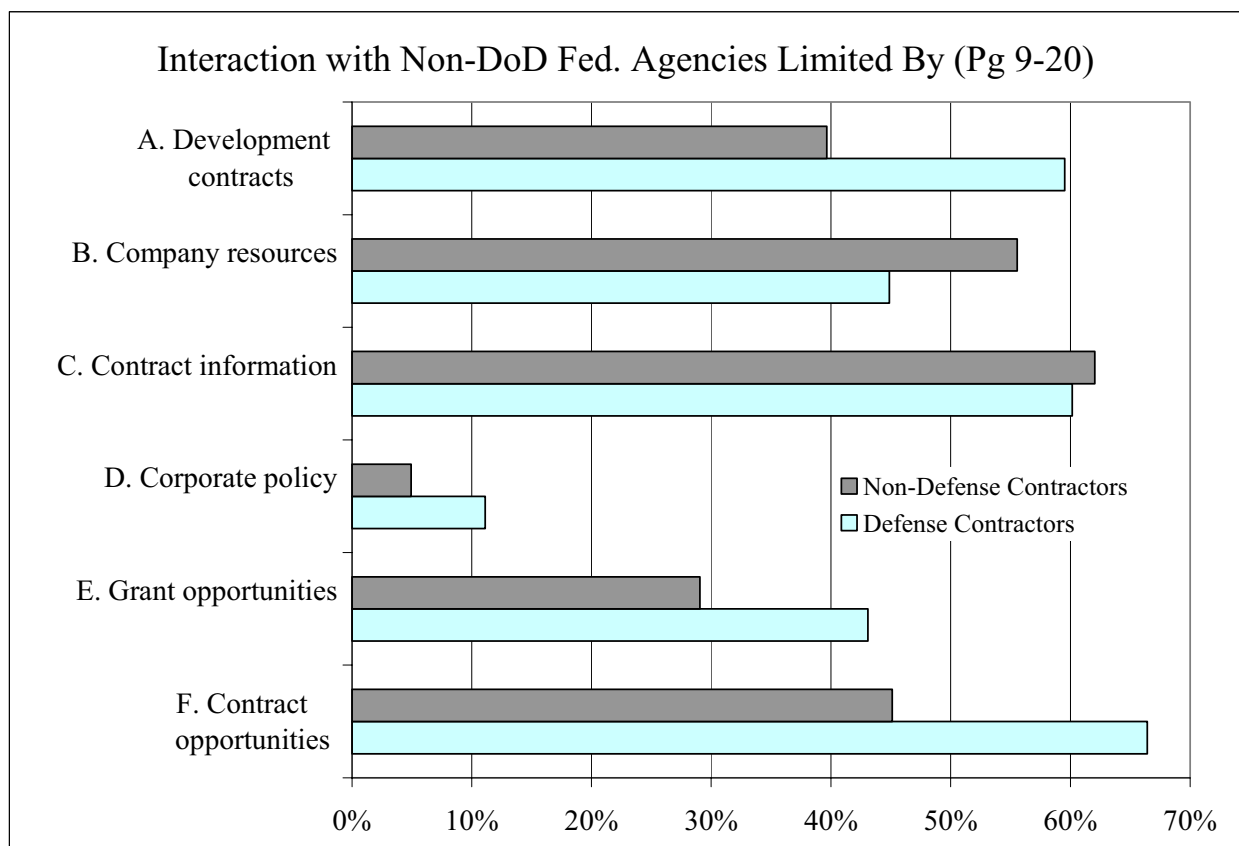
5.7 Why Business Interaction with Federal Agencies and Labs is Limited

Questions 20 and 21 on page 9 asked companies to review a list of factors that might limit their interaction with non-defense federal government and Defense agencies and labs, respectively. These questions were of the yes/no type. Question 20 listed six factors labeled A to F and question 21 listed eight labeled A to H. A blank category labeled G for question 20 and I for question 21 was provided for companies to write-in additional limiting factors. All listed factors in question 20 were also in question 21, although not in the same order. Additional factors in 21 included (B) limited to the scope of business products and services and (H) because products have no DoD application. About 80 percent of the firms responded to these questions.

Question 20 asked respondents to identify factors that limit their interaction with non-defense federal agencies and labs. Defense contractors leading constraint was a lack of contracts (66.4

percent). This was followed by a lack of information on contracts and R&D opportunities (60.2 percent) and limited to circumstances where a federal agency contracted my firm (59.5 percent). The lowest value was corporate policies restricting involvement (11.1 percent). Non-defense contractors cited their chief limitation as the lack of information on contracts and R&D opportunities at 62.1 percent. Second was by business size and resources, which was 55.6 percent (item B on graph). No other answer exceeded 45.1 percent. Interestingly, corporate policies restricting involvement registered only 4.9 percent (9 yes; 173 no), which rules that out as a constraint.

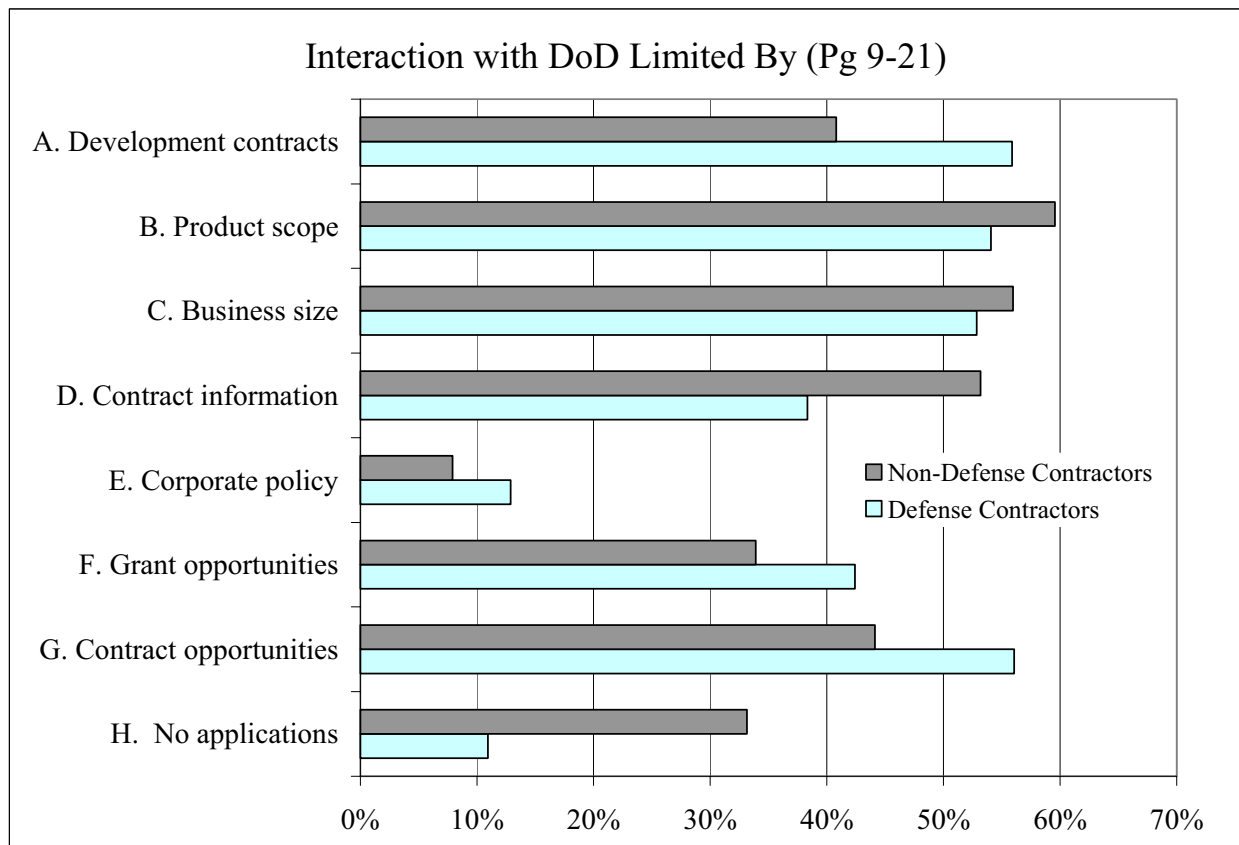
Write-ins predominantly cited lack of experience and lack of relevance. Other comments included limited opportunities, not enough volume, and compliance and audit issues. The following graph presents companies responses to limitations to their interaction with non-defense federal agencies.



Question 21 asked respondents to identify factors that limit their interaction with Defense agencies and labs. Defense contractors, as they had for non-defense federal government

agencies, identified lack of contracts (56.1 percent) as their leading constraint. Three other limitations scored above 50 percent included limits to circumstances where a federal agency contracted my firm (55.9 percent), to the scope of business products and services (54.1 percent), and by a lack of information on contracts and R&D opportunities (52.9 percent). Non-defense contractors cited their chief limitation as the scope of business products and services (59.6 percent) followed by the lack of information on contracts and R&D opportunities at 56 percent. Third was business size and resources, which chimed in at 53.2 percent. All other constraints for both defense and non-defense contractors were below 50 percent. Based on these results, most companies would welcome additional involvement with the Defense Department.

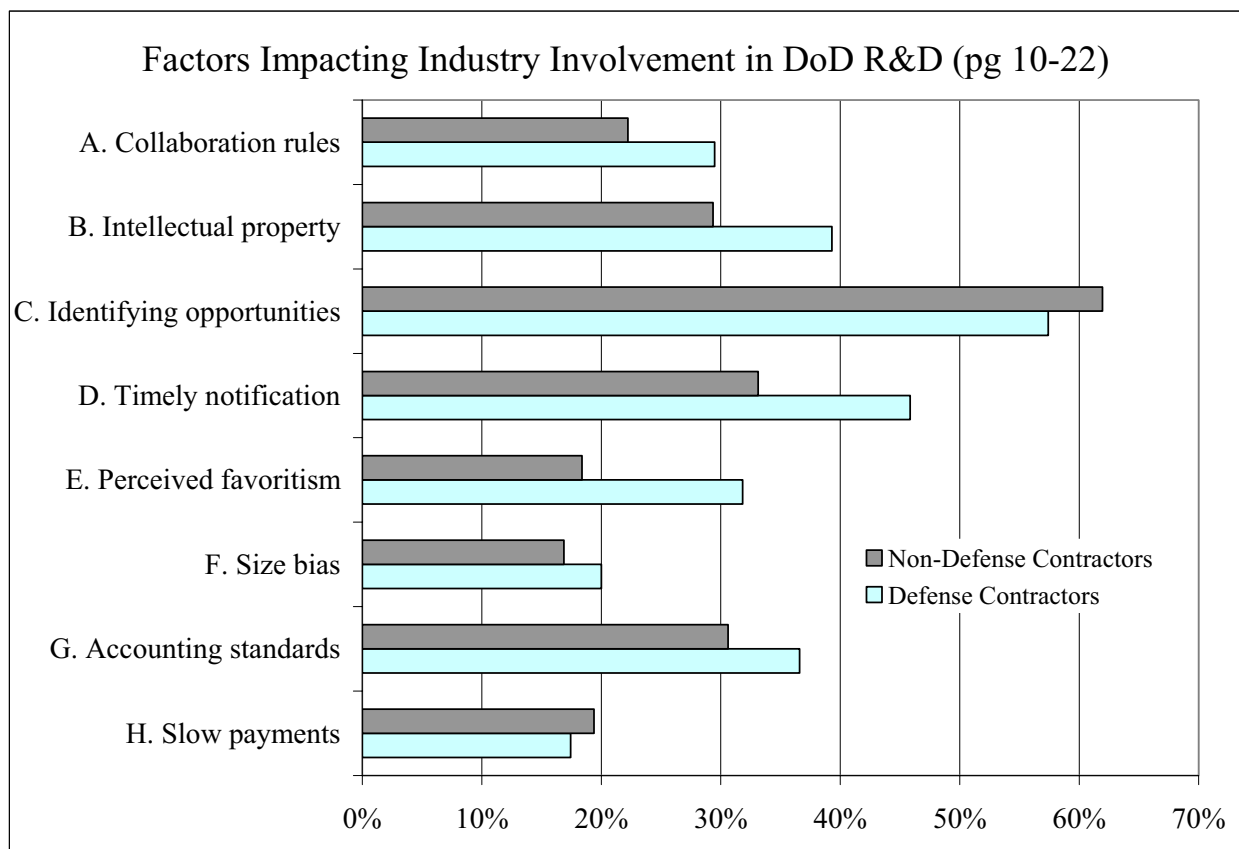
As in question 20, write-ins cited lack of experience or lack of relevance as major limitations for many firms. Other comments included commercial priorities take precedence, inadequate financial rewards, protecting proprietary information, and compliance and audit issues. The following graph presents companies' responses to limitations to their interaction with defense agencies.



5.8 How Can Involvement with Defense Agencies be Increased

Question 22 on page 10 asked companies to identify factors that constrained their involvement in defense R&D and manufacturing programs. The question listed eight possible concerns labeled from A to H. A blank category labeled I was provided for companies to write-in and evaluate additional factors. The four options ranged from disagree, slightly agree, agree, and strongly agree.

Both defense and non-defense contractors cited the difficulty in identifying opportunities as their chief constraint. Defense contractors recorded 57.4 percent for this response, and non-defense contractors 62 percent. Almost 46 percent of defense contractors cited lack of timely notification as their second concern. All other concerns were less than 40 percent. Write-ins again mentioned companies' lack of experience and the relevance of their product. Others cited difficulties with bureaucracy, government program stability, and lack of financial benefit. A few companies stated they were not interested. The following chart presents this information.



5.9 Collaboration with federal Agencies and Labs

Question 23 on page 10 and question 24 on page 11 asked companies to identify areas where they seek assistance, collaboration, or contracts with federal agencies and labs. Each question listed six factors labeled from A to F. The questions were yes/no types. The response for “No” had two forms: first “No” without qualification, and second “No, but want to.” Note that companies responding “No,” without any qualifications could not also respond “No, but want to.” The responses were mutually exclusive. The following table presents the results for both questions, which will be followed by a written discussion.

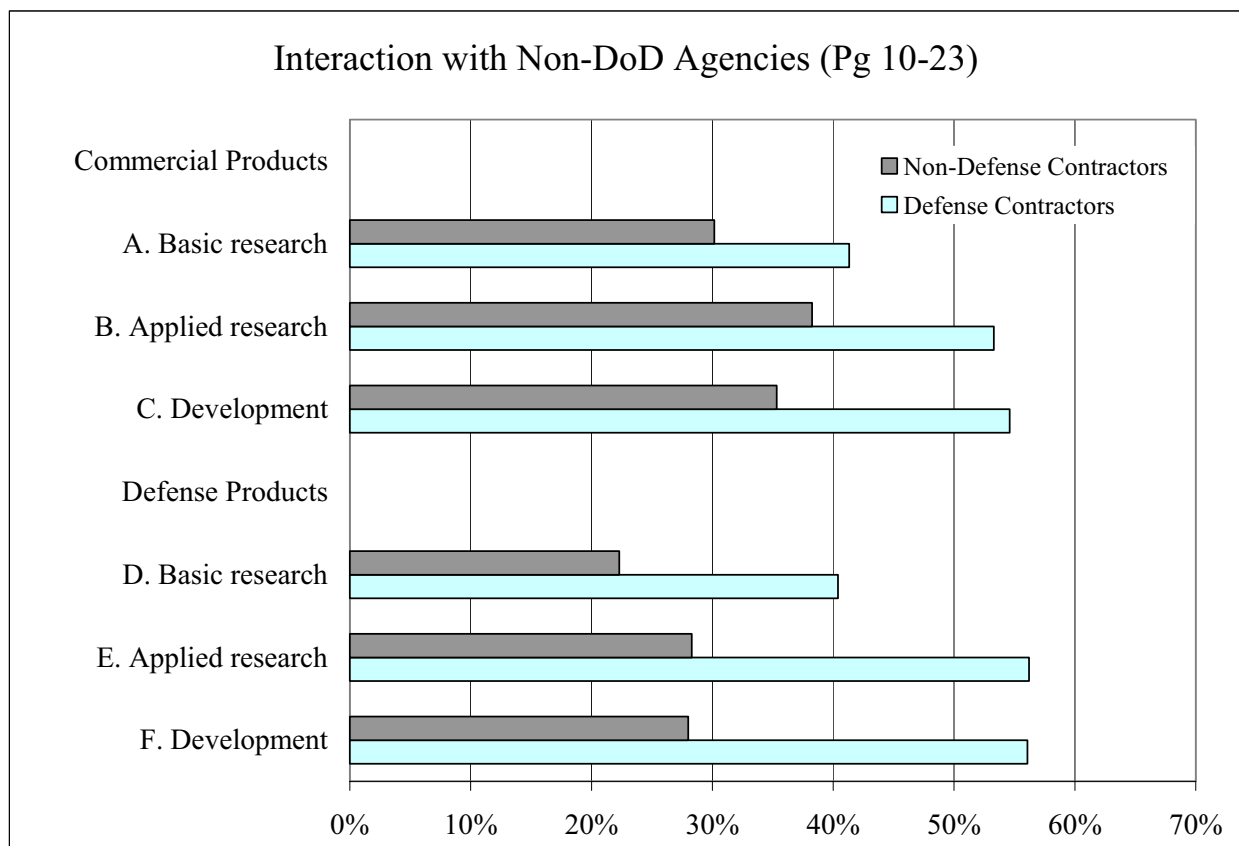
10-23. Does your business confer with, seek the assistance of, collaborate with, or contract with Non-DoD agencies and labs on?								
Stage and Intended Use of R&D	Defense Contractors				Non-Defense Contractors			
	Total Response	% Yes	% No, Want to	Total Yes & Want to	Total Response	% Yes	% No, Want to	Total Yes & Want to
A. Basic for commercial	150	22.0%	19.3%	41.3%	252	11.9%	18.3%	30.2%
B. Applied for commercial	152	23.0%	30.3%	53.3%	251	12.7%	25.5%	38.2%
C. Eng./Dev. for commercial	152	22.4%	32.2%	54.6%	252	11.9%	23.4%	35.3%
D. Basic for defense use	151	15.2%	25.2%	40.4%	251	2.4%	19.9%	22.3%
E. Applied for defense use	153	24.2%	32.0%	56.2%	251	3.2%	25.1%	28.3%
F. Eng./Dev. for defense use	148	23.0%	33.1%	56.1%	250	4.4%	23.6%	28.0%

For question 23 on page 10, note that less than 25 percent of defense contractors responded in the affirmative in regard to non-defense federal agencies for each of the six listed stages. Thus, more than three-quarters of the companies do not confer or seek the assistance from the non-defense public sector at the research, engineering, or development level relating to either commercial or defense usage.

The percent that reported no, but want to was over 30 percent for four of the listed stages. Adding the affirmative and no, but want to responses together, the same four stages exceeded 50 percent. The two stages less than 50 percent were basic research relating to either commercial or defense usage. Both of these were closer to 40 percent. One possible conclusion about this difference, collaboration in basic or applied research is more distantly pre-competitive, and in these areas government funding may be a substitute for private funding, since private funding may be more difficult to justify. Another conclusion, based on the small affirmative response to the question, is that most of these companies are not directly involved in basic research.

The response of non-defense contractors was much weaker. Affirmative responses were all below 13 percent. Engineering and development related to defense products was only 2.4 percent; in fact, only six firms of 251 responded affirmatively. Understandably, significantly more companies reported in the affirmative for categories related to commercial usage than for defense, although the values remain small. In addition, relatively fewer firms indicated no, but want to, where percentages ranged from about 18 to 26 percent.

The following chart illustrates the percentages by contractor group for the combined affirmative and want to responses just discussed.

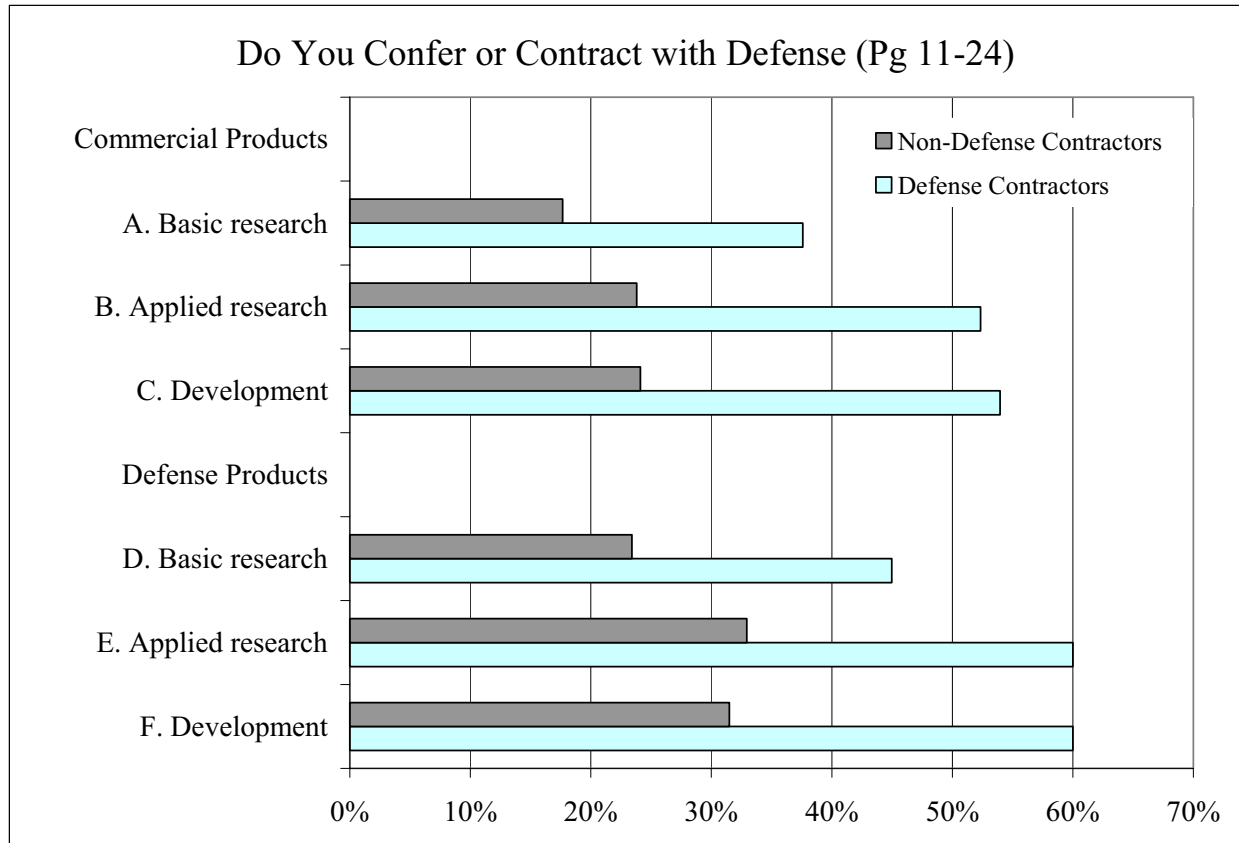


11-24. Does your business confer with, seek the assistance of, collaborate with, or contract with DoD agencies and labs on?

	Defense Contractors				Non-Defense Contractors			
Stage and Intended Use of R&D	Total Response	% Yes	% No, Want to	Total Yes & Want to	Total Response	% Yes	% No, Want to	Total Yes & Want to
A. Basic for commercial	149	19.5%	18.1%	37.6%	255	2.0%	15.7%	17.6%
B. Applied for commercial	149	30.9%	21.5%	52.3%	252	3.6%	20.2%	23.8%
C. Eng./Dev. for commercial	152	29.6%	24.3%	53.9%	253	3.6%	20.6%	24.1%
D. Basic for defense use	149	18.1%	26.8%	45.0%	252	2.0%	21.4%	23.4%
E. Applied for defense use	150	30.0%	30.0%	60.0%	252	4.8%	28.2%	32.9%
F. Eng./Dev. for defense use	150	28.7%	31.3%	60.0%	254	4.7%	26.8%	31.5%

Question 24 asked the same question as 23, but in regard to collaborations with the Department of Defense. Responses were very similar for defense contractors. Most categories showed gains in the affirmative response, while those that responded no, but want to were smaller. The combined totals were marginally down for commercial usages and up for defense.

Non-defense contractors were remarkably low in the percentages responding in the affirmative. The high was only 4.8 percent. The companies that checked no, but want to were also in the minority, but a much higher proportion than the affirmatives. The following chart provides a profile of these responses.



5.10 Changes in Government Laws and Policies

Question 25 on page 11 asked companies to write-in what changes in federal law, policy, operations, and program management are needed to make working with DoD organizations more attractive and productive. In all 167 companies submitted 209 written comments in response to this question, which were parceled into the same six major issue categories as questions 13 and 15 on pages 7 and 8 of the survey. Ninety-one defense contractors submitted 115 of the comments and 71 non-defense contractors submitted 94. In addition, 52 submissions were deleted that lacked an opinion. These were generally non-defense contractors, many with no direct contact with the federal government.

More companies recommended simplification in the regulatory environment than any other issue by a wide margin; what we refer to as procurement complexity. Almost two-thirds of defense contractors suggested changes in reference to this issue alone, and over 50 percent of the non-defense contractors. The upshot of their comments is that the government market is very

different from commercial practices. This difference adds to government transaction costs and may penalize companies less familiar with the process.

A second major issue was communications, this much more so among non-defense contractors. In fact, 31 percent of the non-defense contractors thought communications between DoD and the private sector was inadequate and needed improvement. The following table presents the company responses.

11-25 Changes needed in federal law, policy, operations, and program management to make working with DoD more attractive & productive.						
	Defense Contractors		Non-Defense Contractors		Combined Total	
Major Issues	Cites	Percent	Cites	Percent	Cites	Percent
Procurement complexity	59	64.8%	37	52.1%	96	57.5%
Poor Communication	16	17.6%	22	31.0%	38	22.8%
Intellectual property	16	17.6%	8	11.3%	24	14.4%
Financial Incentives	13	14.3%	10	14.1%	23	13.8%
Small Business	10	11.0%	7	9.9%	17	10.2%
Product Differences	1	1.1%	8	11.3%	9	5.4%
Total Companies	91		76		167	

Many comments were similar or the same made for questions 13 and 15 regarding reducing or eliminating company reluctance to discuss R&D programs with the federal government. Two exceptionally lengthy comments were submitted by aerospace companies, which are reproduced here in their entirety. One company was identified in the special sector and the other in the power electronics sector. These are presented in full.

Comment One, start:

“Our key recommendations relate to improving access to information about our R&D opportunities, recognizing the inherent risks in R&D in the performance criteria for contracts, and streamlining the contractual reporting requirements and mechanisms.

For many contractors, especially small organizations and those for whom Government R&D and production contracts are not a dominant business, it is difficult to maintain full awareness of the

R&D opportunities that exist. [We suggest that the government be more proactive in pushing the information on R&D opportunities to qualified and interested contractors. This will ensure government access to very creative and productive solutions that do not reside with the established players.]

One way to accomplish this is to establish a database of all contractors and would-be contractors, along with their self-identified capabilities, resources and interests. Contractors should be able to update their info online in real-time. The government then pushes the info on all new procurements compatible with a certain subset of interests and capabilities to the applicable contractors to give them the opportunity to compete for the job.

Contractors could give permission to share their database info with large contractors and systems integrators who may be looking for subcontractors on large procurements. [Just the on-going awareness of the government's interests may prompt companies to target their independent R&D toward the government's needs.]

Another strategy for R&D alignment is to provide the major R&D procuring agencies with a pool of funds that can be awarded as tax credits to companies who can use their own funds to conduct R&D beneficial to the government. This would push companies to tune their R&D to the government's need and toward dual-use synergies.

A key aspect of this would be to avoid the cost and bureaucracy of past R&D reimbursement programs, and to leave it to the discretion and judgment of a senior board within the contracting agency. Such a program might be weighted or otherwise targeted to smaller companies to accomplish the objective of fostering new and creative solutions via wider participation.

Government procurement typically treats R&D contracts as having a fixed outcome in terms of technical results and completion schedule within a certain budget. When these targets are missed - not uncommon if we are truly doing R&D - the environment is not very forgiving and reserves may not be available to deal with what should be a statistically expected condition. We recommend that success criteria for R&D be viewed more as [statistical] distributions, and that reserves be held and allocated to worthy projects by the contracting agencies.

Obviously, safeguards against sheer non- or mal-performance must still be applied. [Lastly, the reporting requirements and mechanisms for R&D should be streamlined, simplified, and tailored to the nature of the work.] Some progress seems to have been made in this arena, but we recommend that continuous critical review and improvement efforts be maintained.”

Comment One, end.

Comment Two, start:

“Fully use flexibility allowed in existing laws and national policies for commercial practices and contracts.

A fundamental problem is that the government's determination of fee/profit does not consider private investment recovery (e.g., incurred cost and G&A = total cost, and then a percentage for fee/profit is applied). This approach assumes the government has participated in the investment of the particular product or service, through recovery of IR&D and B&P [bid and proposal] on government contracts. This is not the case for privately-funded products and service, which must be offered and contracted on a "market price" basis.

Government use of commercial acquisition practices and creative investment incentives could help existing and emerging commercial companies provide competitive services to the government as well as develop new markets and compete for business worldwide. Unfortunately, the government continues to use traditional acquisition regulations and procedures when commercial products, services, practices and mechanisms are available. The use of the traditional approach seems to arise from a lack of adequate training of government acquisition personnel in the use of commercial practices and a risk-averse acquisition culture that discourages innovation. Consequently, much procurement that would benefit from commercial designation is not so designated, and instead is structured using more traditional acquisition procedures.

In many circumstances, commercial companies must either forgo government business opportunities or compromise their commercial business model by accepting contracts with many expensive, government-unique requirements. When a commercial company forgoes government business, the government misses the opportunity to access innovative, competitive products and services from a non-traditional government source.

The use of commercial practices and contracting mechanisms in government acquisitions can be a "win-win" situation. Commercial practices and contracts are useful, effective management tools for the government to meet its needs by focusing resources on mission success (i.e., to pay for performance and results rather than overhead). They also allow companies to provide their commercial products and services to their government customers at competitive prices, making the American tax dollar stretch further.

Commercial practices encourage innovation and efficiency, making the U.S. industrial base more competitive by lowering costly and burdensome expenses related to non-productive government-required activities and reporting. This, in turn, frees up manpower and capital to stimulate new

markets and creates incentives for the private sector to develop new technology. (See white paper from Aerospace Industries Association on "Creating an Environment for Commercial Practices and Investment in Space," (See Appendix III) or at time of this writing the article is available at:

www.aia-aerospace.org/issues/commission/commission_spacepractices.pdf).

Comment Two, end.

5.10.1 Procurement complexity

Defense Contractors (cited by 59 of 91)

1. Eliminate federal government cost accounting standards; eliminate cost and pricing data requirements and certifications; and procure R&D on commercial terms and conditions.
2. Streamlined procurement; reduced reporting requirements; and simplified contracts.
3. Accounting control
4. Closer adherence to Commercial Contract and Accounting practices.
5. Continuous streamline acquisition
6. cost accounting requirements
7. Delete the preponderance of DoD/FAR regulations that do not need to be imposed on R&D effort and eliminate reliance of NASA clauses that are unique to NASA.
8. Ease of working with agencies and getting to right people
9. Eliminate all CAS, FAR, compliance, cost accounting, and audit provisions. Liberalize IPR provisions.
10. Eliminate cost principles of the EAR
11. Eliminate federal procurement laws and allow agencies to purchase commercial products.
12. Elimination of "red tape" which slows projects and adds cost. Also, provide a better understanding of any opportunities.
13. Fast track approach to select truly technically competent companies at a reasonable (not necessarily lowest) price
14. Faster process
15. Favored supplier status for R&D companies and provisions for contractual alliance if R&D leads to commercialization
16. For other than R&D, follow commercial practice and delete government unique terms and conditions.
17. Greater acceptance throughout DoD for utilizing commercial products and suiting them for defense use instead of relying on historical government contractors to design from scratch

one shot (or few copy) items. DoD is missing great opportunities to tap into the commercial expertise that is developed.

18. Greatly reduce internal R&D capability of DoD agencies; it inhibits use of industry for DoD.
19. Improve training, shorten acquisition deadlines, eliminate superfluous regulatory oversight and greater use of multi-year (long term) programs/funding.
20. Improved program continuity and delivery schedules
21. In many cases, labs compete with industry due to the recent growth in their technical capabilities. If the labs' involvement was limited, it would encourage more teaming with industry. This limitation could be tied to funding categories. For example: 25% on 6.1 programs, 15% on 6.2 programs and 5% on 6.3 programs.
22. Less bias regarding preferred technical approaches, commercial contracting terms
23. Less bureaucracy
24. Less restrictive export control regulations when dealing with registered Canadian companies
25. Less time consuming to complete bids
26. Long term commitments
27. Make DoD "easy to do business with." Too much red tape, paperwork, controls, etc.
28. Make it simpler/easier to "purchase, rent, utilize" the capabilities available at the labs, etc.
29. Make rules item-specific instead of using the same procurement regulations applicable to both butler and space laser acquisition.
30. Many changes would be required so we suggest working with commercial industry groups like the IDCC.
31. Make paperwork less complicated (especially billing)
32. More streamlined and direct "point of contacts" without as many split responsibility at program/project level.
33. More truly multiyear procurements, elimination of TINA and CAS
34. Multi-vendor telecommunications services environment required. Currently no new providers are able to provide services under FTS 2000 regulations.
35. Possibly less paperwork
36. Procurement and regulations outdated; based on 20-year life cycle, etc. Change procurement laws to recognize today's technology life cycle and the fact that 2/3 of funding for R&D in the U.S. comes from private sector. Government needs to make it easier for contractors to "sell" them technology.
37. Procurement Process needs to be streamlined to allow cost appreciation and in turn, deliver product to consumer in a timelier manner.
38. Procurement regulations need to be revised to promote the use of commercially available technologies rather than reinforcing cost-plus, invented-here mentalities whereby contractors reinvent the wheel over and over on various programs on a more expensive and less efficient basis.

39. Product changes require too many signatures and take too long to sign off on. Reduce the path to critical people.
40. Recognition of commercial business pricing and project management; broad use of other transaction agreements; updating R&D.
41. Reduce or eliminate administrative oversight in areas of socio-economic programs; financial, property, and certain quality programs.
42. Reduced paperwork. For example, assist by offering on-line downloadable templates in Word or Excel for forms, reports, material control, etc., and more active inquiries (sourcing) from DoD and other Agencies.
43. Relax ITAR regulations, demand "buy America" first.
44. Remove requirements that cause us to maintain two separate legal entities and financials.
45. Require less red tape!
46. Research available commercial alternatives before funding redundant, competitive work.
47. Shorten sale cycles, empower individuals to make decision to implement new technologies
48. Shorten the time required to award a contract
49. Shorter times from R&D to production.
50. Simpler proposals, less onerous contracting procedures.
51. Simplify contracts; institute preferred sourcing status with R&D partners.
52. Simplify procedures
53. Statute that would remove the DOE labs from space work. They are competitors. They also compete with DoD labs. Strictly limit use of OTA and section 845 transactions.
54. Streamline bidding process, make more funding available.
55. The coordination of R&D in space technology across all federal organizations needs to be streamlined. It should be consistent with a Technology Road Map (See Space Technology Alliance). More direct involvement in the Laboratory development and other architecture processes.
56. The SBIR program needs to be eliminated as a method of developing second/alternative sources of supply for production programs and development programs.
57. The willingness of DoD to consider alternative sources for existing and future products is imperative to provide more attractive and productive relationships.
58. Too bureaucratic - massive reporting requirements.
59. Use of more efficient contracting instruments such as "cooperative agreements" and "other transactions" as we do with DOE.

Non-Defense Contractors (cited by 37 of 76)

1. Access to product specifications and simplification of quoting process.
2. Accounting methods should allow direct commercialization charges and patent costs to grants and contracts.

3. Change procurement policy, increase order volumes, shorten bid-delivering purchasing cycles, and reduce vendor qualification period and paperwork involved.
4. Contract to the private sector on certain projects - cost factors discussed and payment plans met.
5. Eliminate bureaucracy. Empower 2 technical representatives. Communicate goals. Stick to long-term commitments. Reward innovation and cost-saving. Simplify application, accounting, and regulatory language.
6. Faster decision making and funding, commitments to quantities beyond prototype, protection of IP and patents.
7. Faster, less red tape, movable to keep confidential and change intellectual property ownership
8. If DoD were to operate in a fully commercial manner.
9. Improve the ease of dealing with the agencies.
10. Improve timing of paperwork.
11. Less bureaucracy, evidenced by this mandated long survey
12. Less bureaucracy.
13. Less legal adversarial relationship, federal acquisition and accounting regulations/red tape simplification
14. Less paperwork
15. Less red tape would encourage more projects.
16. Less red-tape
17. More accessibility, less bureaucracy. Work with private industry in a similar manner in which 2 industries would work together.
18. Most of the DoD research is controlled by DARPA, which favors large projects and incumbent contractors. The DoD research laboratories (AFRL, NRL, ARL) must be empowered to select their own research partners directly.
19. Much less paperwork, reporting, accounting overheads; emphasize dual-use commercial/military.
20. Need fewer laws, not more. Free purchase directories for DAR.
21. Purchase product directly, following standard commercial practices.
22. Reduce bureaucracy with contracts and reduce reliance on government accounting standards because they do not always fit business standards.
23. Reduce paperwork and process overhead (i.e., reporting requirements, meetings)
24. Reduce paper/administrative burden; eliminate outdated standards (i.e. built-in bias for certain suppliers).
25. Reduce security constraints.
26. Reduce reporting mandates and additional compliance requirements.
27. Separate routine procurement postings from those requiring development.
28. Simplified accounting, better marketing of opportunities, simplified procurement procedures

29. Simplify accounting systems
30. Simplify administration, cost accounting and reporting requirements. Major overhaul of government procedures needed. More lead time is needed as resources very thin.
31. Simplify the rules.
32. Simplified contractual and audit procedures.
33. Too complex to simply state what changes are needed.
34. Too complicated [simplify]
35. Uniform MIL Specs that allow use of existing commercial products and mimic actual end-use requirements.
36. Update the labs to current standards of technology.
37. Work with commercial business or commercial terms.

5.10.2 Communications

Defense Contractors (cited by 16 of 91)

1. Better communication of the opportunities to private industry; when receiving a contract, there is a risk that DoD programs could be pulled, leaving our investment in development of the contract worthless.
2. An easy method to help small companies identify opportunities.
3. Awareness of DoD requirements
4. Better communication of needs, timeliness
5. Better communication of collaborative opportunities and federal grant requirements.
6. Communication structure
7. Ease of finding requirements and getting to right people. Ease of working with agencies
8. Fund contracts for products that are suitable for our manufacture.
9. Knowing what if any contracts are available.
10. Made aware of opportunities. Regular information sessions.
11. On one hand, open the system up as much as possible re: contracting information - continual improvement necessary.
12. Provide more information to industry identifying the capabilities available at the labs, etc.
13. Publication and communication of government needs and technical interests.
14. There needs to be better publicity about how to get involved in these programs.
15. We do not know how to begin. We need an easy way to learn how to present my company to DoD.
16. We need to know how and why DoD and non-DoD agencies need specialty films.

Non-Defense Contractors (cited by 22 of 76)

1. Better communicate access channels

2. Better communication on DoD areas of research and development and improved means of identifying opportunities for joint work.
3. Better knowledge of opportunities
4. Better system for distributing requirements and documents, especially at early stage concept development initiatives
5. DoD needs to make inquiries known and seek out services.
6. DoD should, if they want to work with us, have some way to inform us of their interests/needs.
7. Guiding and targeting technical companies like ours to specific projects.
8. Improve programs designed to help companies find opportunities to assist DoD organizations.
9. Knowledge of the programs would encourage more projects.
10. Make policies, opportunities more available (paraphrased answer).
11. Make programs and opportunities more visible.
12. Make public lists of technologies DoD is seeking.
13. Make the opportunities within DoD more visible.
14. Require more knowledge of opportunities.
15. Need to understand opportunity.
16. No suggested law changes. The DoD is very large and it is very difficult to find the correct person or department to speak with.
17. Perhaps better dissemination of opportunities including presentation of business benefit. On-site presentations to companies not involved with DoD projects would help. Explain available opportunities and present cases where other companies, not previously involved in DoD projects, realized a business benefit.
18. There is a lack of follow-up and the overall process including overall goals has been unclear.
19. Unfamiliar with those laws and policies. There should be a mechanism to bring strategic companies like my company into the national discussion for we are conducting R&D and selling products that will dictate the future of telecommunications.
20. My company would be interested in working with DoD organizations to provide website hosting, video conferencing and video streaming services if it were easier to learn about potential opportunities and if the contractual process was not overly complicated
21. We don't know where to locate information which parallels our capabilities.
22. We need to be able to work with organizations to determine their needs. This requires access to contracts and formations.

5.10.3 Intellectual Property

Defense Contractors (cited by 16 of 91)

1. Allow DoD organizations to enter into and be bound by non-disclosures with respect to intellectual property.
2. Allow exclusivity in intellectual property ownership.
3. Allow data developed under cost share type agreements to be treated as "Limited Rights" data by the government.
4. Changes in intellectual property ownership rights allow companies more control and protection of their IP. This is particularly needed in those cases where IP was born out of companies' research and development work. DoD needs to invest more in technology development, reduce the cost match percentage required in other transaction agreement contracts.
5. Improved data rights.
6. Improved understanding of rights in technical data.
7. Intellectual property rights
8. Intellectual property, re: procurement rules
9. Issues dealing with intellectual property regarding services paid for and use of product developed from those services.
10. Make intellectual property rights the same for Canadian and US companies with industry owning the inventions.
11. Protect confidential information of companies in a way that penalizes individuals that misuse provided information. Allow companies to retain ownership of confidential information.
12. Protection of proprietary information
13. Provide better IP protection - tough to reach a proper balance - continual improvement necessary.
14. Stronger non-disclosure language in contracts
15. Update R&D IP clauses to reflect commercial partners' R&D.
16. We would be prepared to work for the DoD if we did not have to obtain and maintain security clearance.

Non-Defense Contractors (cited by 8 of 76)

1. DoD wants best available technology but also hates to be sole sourced. If you get a unique product approved, DoD will push your competition to copy it. Therefore, you do not always feel rewarded for providing the best.
2. Guarantee intellectual property security.
3. Improved management of intellectual property.
4. Keep proprietary information protected.
5. Protection for company intellectual property.
6. Protection of intellectual properties - not government owned.
7. Strengthen confidentiality.
8. W.R.T. Patents, I/P ownership and use.

5.10.4 Financial Incentives

Defense Contractors (cited by 13 of 91)

1. A consistent and reliable funding plan with multi-year committed funding.
2. Discourage DoD agencies from seeking industry cost sharing; recent DoD policy statement is not being adopted uniformly.
3. DoD must continue to fund R&D for "mature" technology including flight control and propulsion. Only SBIR's remain funded in these broad areas. Funding has been near zero for many years.
4. Greater return on investment
5. It would benefit private contractors if more basic science and research funds were available instead of being directed to government labs and organizations.
6. More consistent funding and higher allowable profits
7. More government funds for dual-use R&D and transition!
8. More projects/contracts and less "low price" contract awards, source credit for quality and delivery, as well as R&D, cost sharing program for improving value (price, quality, life, services).
9. Our R&D is directed at opportunities for production. When an R&D opportunity does not have a clear production opportunity there is little interest in the R&D opportunity.
10. Prompt payment
11. Prompt payment of progress payments and better adherence to program time lines.
12. Speed up contract progress payments; increase allowable contract.
13. The intellectual property ownership and R&D collaboration rules need to be changed to assume an adequate return on investment can be generated.

Non-Defense Contractors (cited by 10 of 76)

1. A shorter cycle with regard to "time to revenue". My company's experiences with SBIR R&D are that from the time the contract is awarded until funds begin to flow to the company is much too long. With a shorter cycle we would be more aggressive in pursuit of government contracts.
2. Improve ability to make profit.
3. Improved timing of payments.
4. Make them more appealing.
5. More latitude in use of funds
6. More profit margin
7. Multi-year programs - consistent funding, more favorable terms and conditions
8. Need financial incentive.

9. Offer incentives to collaborate with DoD. Possible tax incentives for R&D efforts in conjunction with DoD projects.
10. Permit greater company profit.

5.10.5 Small Business

Defense Contractors (cited by 10 of 91)

1. Do not use Research and Development Contracts as an automatic set aside for small business.
2. DoD organizations collaborate primarily with Prime Contractors; they should work with the subcontractors that supply products and processes to the Primes.
3. Increase preference for small businesses.
4. Make it easier for small companies to be aware of federal opportunities.
5. Make opportunities available to consulting firms of smaller size. This would save government money due to lower overhead.
6. More stress on R&D by small business.
7. Most contracts are awarded to the Primes. Award more contracts directly to the subcontractors and keep them simple and straightforward so they can be managed at lower costs.
8. One major issue is that the DoD agencies use large defense contractors and do not use innovative "off the shelf" solutions from small companies. This needs to change so that more fast paced smaller companies can successfully work with DoD organizations.
9. Reduce or eliminate growing requirements for cost sharing for small businesses, especially in SBIR/STTR program. Current policy seems to make cost sharing mandatory for Phase II funding.
10. My firm has not had any direct business relationship with the federal government. We would like to engage in a business relationship with the federal government if the government processes, procedures, and standards requirements were simplified for small organizations.

Non-Defense Contractors (cited by 7 of 76)

1. Available funding for small businesses.
2. DoD should work with small companies.
3. General recognition of limited resources of small companies.
4. I work for a small company that is a fully-owned subsidiary of a larger company.
Consequently, we are not a small business and don't get the benefits. Please change the definition of small business in regard to government technical R&D contracts (SBIR, etc.)
5. It will be helpful if DoD can promote joint R&D programs designed for smaller companies.

6. More money for small business research programs. Ability to collaborate with larger companies in limited activities, with the goal of enhancing the technical and market success of the developed project
7. Small companies do not have the resources to follow the myriad rules necessary to compete with R&D at the federal level.

5.10.6 Product Irrelevance

Defense Contractors (cited by 1 of 91)

1. Our current working with DoD is through our joint venture with another company. That company maintains and handles the relationships and contracts

Non-defense Contractors (cited by 8 of 76)

1. Again our products are not related to core competitors in the DoD
2. No comment- our firm has no particular interest in working with any Governmental agencies as our products are solely for the commercial marketplace.
3. Not qualified to answer this question since we have no experience in this area. For our company it is a matter of focus, some companies focus on military/government work as a business strategy and structure their businesses accordingly; we do not.
4. Not sure. Our business has little, if any, overlap with the interest of DoD. Some of our customers do have involvement with DoD and other federal agencies
5. My company's technology is not useful to DoD
6. Technology must match between DoD and our business.
7. We are only interested in commercial business.
8. We don't see any application for our products within DoD or non-DoD related government organizations.

5.11 Types of Agreements

Question 26 on page 11 asked companies to identify types of agreements they had with any federal agency involving R&D conducted since 1998. The question listed six agreement types labeled from A to F. A blank category labeled G was provided for companies to write-in additional agreement types. The question was a yes/no type. If the response was "Yes, the company was asked to identify if the arrangement was with DoD and/or another federal agency.

Roughly 40 percent of the defense contractors have some sort of R&D agreement with the federal government. Less than 10 percent of non-defense contractors had such agreements. The

predominant form of agreement was research and development contracts. About 20 percent of defense contractors were involved in CRADAs. Very few were engaged in joint ventures or technology licensing.

Most of the agreements were with the Department of Defense, although other federal government agencies were well represented. Many companies that cited R&D agreements with DoD also cited agreements with non-DoD agencies. Write-ins mostly cited agreements with other companies. Additional write-ins cited various types of interaction with the federal government, such as supply contracts, sharing test results, and SBIR. The following table reflects this information.

11-26 For the purposes of conducting R&D, since 1998 has your business and <i>any federal agency</i> entered into a...								
	Defense Contractors				Non-Defense Contractors			
Types of Agreements	Yes	No	With DoD	Other Federal Agency	Yes	No	With DoD	Other Federal Agency
Joint venture	9	137	5	4	2	246	6	0
Formal Cooperative Research and Development Agreement (CRADA)	31	119	16	17	9	236	7	5
Technology license	9	139	6	4	7	240	6	4
Formal Work-for-others agreement	10	136	6	5	4	243	6	2
Other formal collaboration	13	132	7	5	1	244	6	1
R&D contract	57	93	34	25	9	239	7	5
Other	8	13	5	2	6	34	1	2

Question 27 on page 12 asked companies that responded “Yes” to question 26 to report the number of agreements with listed federal government agencies from 1998 to 2000, and estimate those for 2001 and 2002. An all other category was provided for other federal agencies not specifically listed. About 3,000 agreements were reported for the five years. The most agreements were identified for 2001 (629). Agreements with the Defense Department were highest in 1998 at 470.

Defense contractors accounted for about 98 percent of the total reported agreements. Significantly, just one company reported about one-third of the agreements, and just 12 companies reported more than 80 percent of the total. The number of agreements provides no insight into their value. We believe the value is also top heavy with perhaps the top 100 accounting for over 50 percent of the total value, although this cannot be verified with the given data.

The Department of Defense accounted for more than three-fourths of the agreements. The Department of Justice was a distant second with about eight percent. The table below shows the aggregated results of those companies that reported R&D agreements with various federal government agencies.

12-27 If you answered “Yes” in <i>Question 26</i> , please report the number of agreements with each listed federal agency for each year in the table displayed here.						
<i>AGENCY</i>	<i>YEAR</i>	1998	1999	2000	2001**	2002**
Central Intelligence Agency		0	0	12	1	0
Department of Commerce		20	11	13	12	8
Department of Defense		470	455	383	433	421
Department of Energy		18	21	31	53	38
Department of Justice		40	42	52	53	50
Dept of Transportation		0	3	1	2	1
Environmental Protection Agency		1	2	4	5	3
Nat’l. Aeronautics & Space Admin		29	26	30	44	19
National Institutes of Health		0	0	0	0	0
National Science Foundation		2	1	4	2	2
National Security Agency		1	2	2	2	0
Other Agencies		19	26	21	22	20
Column Total – Total Agreements		600	589	553	629	562
with Defense Contractors		588	576	542	613	550
with Non-Defense Contractors		12	13	11	16	12

**Estimates

5.12 Private R&D Projects and a DoD Database

Questions 28 and 29 on page 12 asked companies about their R&D projects. The questions were yes/no types. Question 28 asked if the companies were currently engaged in R&D projects that might be of interest to DoD. Two additional options were, “perhaps, but need more information” and “perhaps, but we do not intend to pursue DoD uses”. Question 29 follows by asking the companies if they would be willing to place R&D project information into a DoD restricted access database.

Question 28 asked the companies if they were engaged in R&D projects that might be of interest to the Department of Defense. About 55 percent of defense contractors responded in the

affirmative, another 21 percent thought perhaps, but needed more information, and 3.9 percent thought perhaps, but do not intend to pursue. Only 14 percent of non-defense contractors answered in the affirmative, another 27 percent thought perhaps, but need more information, and nine percent thought perhaps, but were not interested in pursuing.

Twenty percent of the defense contractors and 50 percent of the non-defense contractors responded with an unqualified no, which may be interpreted to mean they do not engage in research or development. Overall, this was about 39 percent of the all companies filing surveys with the Commerce Department. Another 3.9 percent of defense contractors and 9.1 percent of the non-defense contractors do not wish to pursue the issue, although they apparently have on-going research and or development projects. In any case, these are presumably out of DoD's reach based on survey results. Combining these with the unqualified no answers indicates more than 45 percent of the companies are unable or unwilling to share technology with DoD. These results are shown on the following table.

12-28 Are you currently engaged in any research and development projects that you believe might be of interest to DoD?			
Response Categories	Defense Contractors	Non-Defense Contractors	All Contractors
Yes	84	37	121
Perhaps, need more information	33	70	103
Perhaps, don't intend to pursue	6	24	30
No	31	132	163
Total Responses	154	263	417
% Yes	54.5%	14.1%	29.0%
% perhaps, need more information	21.4%	26.6%	24.7%
% perhaps, don't intend to pursue	3.9%	9.1%	7.2%
% No	20.1%	50.2%	39.1%

Question 29 asked the companies if they would be willing to place information about their R&D projects into a restricted database for use within the Department of Defense. The responses were

consistent with the previous question. Among defense contractors, 96 of 142, or about two-thirds responded in the affirmative. This roughly compares with 84 affirmatives and 33 that checked perhaps, but need more information of 154 that responded to question 28, or about three-fourths that responded favorably.

The non-defense contractors responded with 100 affirmatives out of 244 that answered the question; a total of 41 percent. For question 28, 30 firms answered yes and another 70 said perhaps, but need more information; this was very close to 41 percent. In general, the closer a technology gets to the competitive horizon the less likely most companies are willing to share the data. This could at least partly explain the slight variation in defense contractors' willingness to share their data between questions 28 and 29. The Defense Department could strengthen its intellectual property obligations, or even consider compensating companies for unauthorized disclosures to possibly allay these concerns. The following table presents the responses to question 29.

12-29 Would your company be willing to place information about its research and development projects into a restricted access database for use within DoD?			
	Defense Contractors	Non-Defense Contractors	All Contractors
Yes	96	100	196
No	46	144	190
Total Responses	142	244	386
Percent Yes	67.6%	41.0%	50.8%

5.13 Reluctance to Participate in DoD R&D Database

Question 30 on page 13 asked companies to identify reasons they would not participate in a DoD R&D database, and is a follow-on to the previous two questions. The question listed twelve reasons labeled from A to L. A blank category labeled M was provided for companies to write-in and evaluate other reasons. The four options ranged from not at all, slightly, moderately, and greatly.

Defense contractors major concern affecting their decision to participate in a defense research and development database was risking loss of proprietary information. This concern scored 69.1 percent. Of 149 defense contractor companies reporting, 70 (47 percent) indicated their decision would be influenced greatly by this concern, and another 40 companies cited moderately. Not far behind this concern was the influence of no economic benefit (66.4 percent), potential loss of

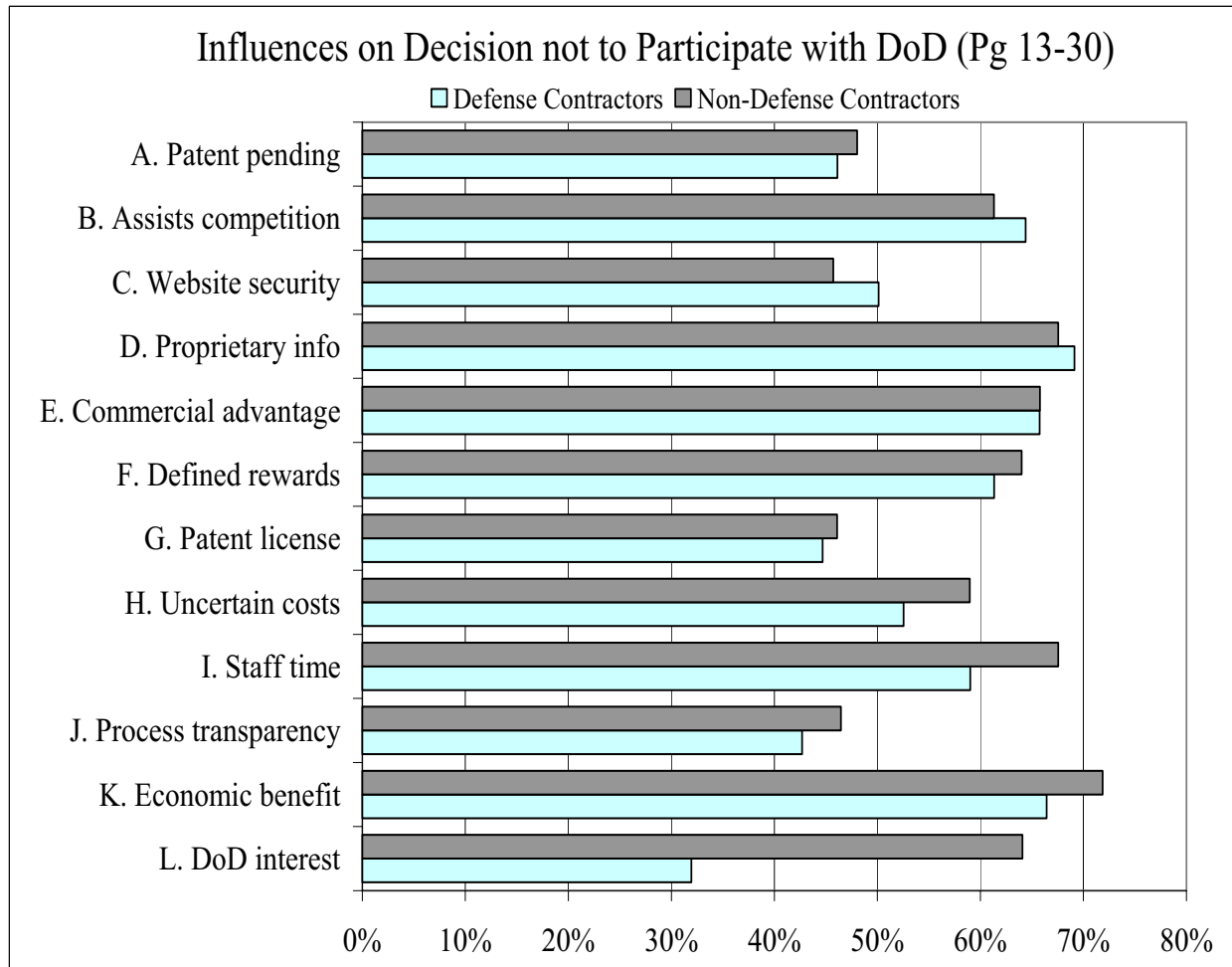
competitive advantage (65.8 percent), assists competition (64.4 percent), and poorly defined awards (61.3 percent). For all 12 reasons listed, defense contractors averaged 54.7 percent.

Non-defense contractors' major concern was no clear economic benefit, which at 71.9 percent, included 114 companies (about half) of the 231 respondents citing it influences them greatly. Second was the requirement for too much staff time, followed by risking loss of proprietary information, both about 67.6 percent. The fourth reason at 65.8 percent was loss of competitive advantage. Seven of the 12 reasons recorded more than 60 percent. The average for all reasons was 59.1 percent, with more than one-third on average marked as influencing the companies greatly.

It is evident that concerns for intellectual property are a big issue for both sets of firms. This is also an issue in the previous two questions and other areas of the survey. Intellectual property relates to several reasons such as risks loss of proprietary information, potential loss of competitive advantage, and assists competition, which ranked one, three, and four for defense contractors and three, four, and seven for non-defense contractors. Another major area of concern is economic. This area too relates to several questions in other areas of the survey. Related reasons include no clear economic benefit, poorly defined rewards, too much staff time, and uncertain costs. These reasons ranked two, five, six, and seven for defense contractors and one, six, two, and eight for non-defense contractors.

A big difference between defense and non-defense contractors was their evaluation of defense not a major factor in areas of interest, which is not surprising. Here, defense contractors recorded only 31.9 percent compared to non-defense contractors with more than twice the influence at 64.1 percent. Almost half the defense contractors cited not at all (70 of 143) while about 20 percent of the non-defense contractors (42 of 219) did the same. At the other extreme, only 18 defense contractors (13 percent) and 92 non-defense contractors (42 percent) cited greatly.

This may be a reflection of differing experience levels between the two groups, which influences their perception. It may also be an accurate reflection of the underlying reality, where non-defense contractors' technology is generally not relevant to defense. This second argument would appear to support the smaller firm = narrower capability hypothesis presented in the firm capability section (see page 7***** on Business Activity). The following chart presents the data in graphic form.



5.14 Product Cycle Times

Question 31 on page 13 asked companies to identify product cycle times from R&D to marketable products. They were asked to indicate these times in years or in months as applicable to their situation. For presentation purposes, all data was converted to months. A total of 73 defense contractors (46.2 percent) and 109 non-defense contractors (40.5 percent) responded to the question. In addition, 24 responses of 43 possible were received from companies in the special category. This special category data regarding product cycle timing is presented for comparative purposes. Average and median cycle times and standard deviations were calculated for each technology.

For the four technologies under review, 182 companies provided information on their product cycles. The average time from R&D to marketplace was 21.4 months with a median (or mid-

point) of 12 months. Companies ranged from only one month to 12 years, and the standard variation was 22 months. If anything, these numbers show the technologies and products under review are highly differentiated with numerous variations. What is true in general is also true for the individual technologies, as each showed this characteristic. The special category showed an average of 41.4 months, median of 36 months, and a standard deviation of 13.7 months.

The differences in average cycle times between defense contractors and non-defense contractors were significant for advanced composites and power electronics. In both cases, the average cycle times of non-defense contractors were much longer. However, only eight reports were received for advanced composite defense contractors, which could easily misconstrue the data. The average of 13.1 months is about 35 percent less than the 20-month average recorded for the more numerous non-defense contractors. One firm reported 144 months as its product cycle, which was four times longer than anyone else. If this firm is removed from the aggregate calculation, the remaining non-defense contractors fall to 15 months which appears to be more reasonable. Non-defense power electronics companies also showed longer cycle times than defense contractors at 26.9 months versus 21.6 months. The median for the defense contractors is 18 months, while that for non-defense contractors is 24 months.

Another method of viewing variation is to look at the middle 80 percent of the companies in terms of cycle times, or lop-off 10 percent from each end of the distribution. This will remove the extremes on both the low and high ends and automatically reduce the standard deviation. In addition, by cutting off the upper extreme the average cycle time will fall because the high extremes have no limit while the minimum cannot be less than zero. Thus, the middle 80 percent (146 companies) averaged 17.5 months cycle time with a standard deviation of 9.8 months. Not surprisingly, the range narrowed considerably, varying from 3 to 36 months, instead of 1 to 144 months in the larger database.

Not all of the 182 companies reported they perform research, although close to 95 percent did. About 60 percent of the firms, however, do not consider their R&D programs one of the major activities of their business. Their average cycle time was 16.7 months. The firms with research activity were more than 26 percent higher than those without. The longer cycle time for firms with research as a major activity is not entirely unexpected. Firms active in development should have a shorter cycle time, all else being equal. We cannot report how many research firms were actually reporting their research cycle; some may have reported their development cycle, which would muddy the calculation. However, the difference is intuitively obvious, and the 26 percent is probably a low-end estimate. The following table provides the calculations for each technology and other factors in the discussion of product cycle times.

13-31 For any ongoing research related to your technology, when do you anticipate that the results of your R&D will be available in the marketplace?					
Defense Contractors	Responses	Average	Median	Range	Variation
Advanced Composites	8	13.1	9	3-36	10.6
Batteries	15	19.8	12	6-60	14.0
Power Electronics	34	21.6	18	3-120	21.7
Wireless Broadband	16	21.9	12	1-60	18.5
Total	73	20.4	12	1-120	18.8
Middle 80 percent	59	17.1	12	6-36	9.5
Non-Defense Contractors	Responses	Average	Median	Range	Variation
Advanced Composites	29	20.0	12	1-144	25.4
Batteries	14	20.6	12	2-72	18.7
Power Electronics	29	26.9	24	1-120	22.9
Wireless Broadband	37	20.5	12	1-108	24.7
Total	109	22.1	12	1-144	24.0
Middle 80 percent	87	17.7	12	3-36	10.1
All Contractors	Responses	Average	Median	Range	Variation
Advanced Composites	37	18.5	12	1-144	23.2
Batteries	29	20.2	12	2-72	16.4
Power Electronics	63	24.0	22	1-120	22.4
Wireless Broadband	53	20.9	12	1-108	23.0
Total	182	21.4	12	1-144	22.0
Middle 80 percent	146	17.5	12	3-36	9.8
Special Category	Responses	Average	Median	Range	Variation
Defense Contractors	22	43.6	36	3-120	13.4
Non-Defense Contractors	2	17.0	17	~	~
Total	24	41.4	36	3-120	13.7

6. Federal Procurement and Contracting

As in the previous section, this section presents data separately for defense contractors and non-defense contractors based on respondents answer to question 11 on page 17.

6.1 Federal Contracting

Responses to questions one, two, and three on page 13 are presented on the following table. The first question had to do with the companies' previous experience in competing for a government contract. Almost 92 percent of defense contractors indicated they had competed for a government contract. We assume the eight percent (13 of 154) that had not competed were subcontractors to defense prime contractors and had no direct business with DoD. The majority of non-defense contractors (62.2 percent) competed for (non-DoD) government contracts. Per page 13, question 2 the great majority of defense contractors were interested in supplying the federal government, and a strong majority of non-defense contractors were interested. The same interest is evident for supplying the Department of Defense, shown by question 3.

Federal Contracting Experience and Future Willingness				
Yes/No Questions on Page 13	DoD Contractors		Non-DoD Contractors	
	Number of Responses	% Yes	Number of Responses	% Yes
1. Has your Business ever competed for a federal government contract?	154	91.6%	259	62.2%
2. Is your Business interested in becoming a supplier to the federal government?	150	94.0%	251	61.0%
3. Is your Business interested in becoming a supplier to the DoD?	86	88.4%	251	61.0%
Sub-part of 3: Already work with DoD	68		8	

Combining the responses, the three questions illustrate a willingness to supply the federal government and/or the Department of Defense on the part of most companies. Many view the government as another business opportunity, if not for developing technology, than as a straight sale. The companies that indicated no interest might be content with their current situation or concerned about intellectual property, financial rewards, or regulatory complexity. Some firms, in addition, probably cannot afford the overhead.

Question 4 on page 14 asked the companies how aware they were of the technology capabilities of defense and non-defense government agencies. The four options ranged from not at all, slightly, moderately, and greatly. Responses to this question point to a general lack of awareness about government technology capabilities, even among defense contractors. Of 158 defense contractors, only 18 indicated they were greatly aware of technology capabilities within the Defense Department, and only eight were greatly aware of the capabilities within non-defense federal agencies. Non-defense contractors were even less aware, as might be expected. The majority (152 of 261) of non-defense contractors reported that they were not at all aware of the capabilities of either defense or non-defense federal agencies.

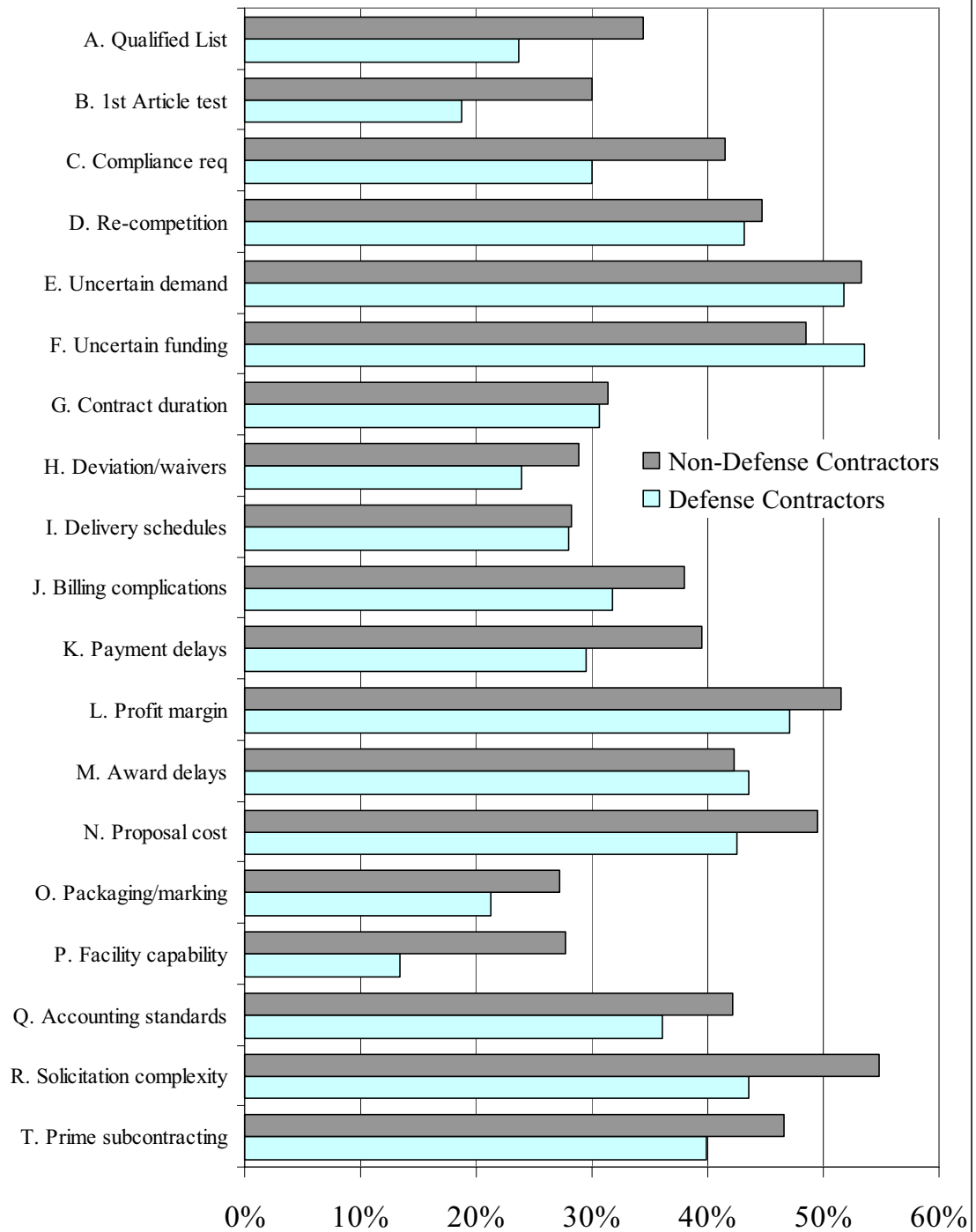
14-4 How aware is your Business of the technology capabilities of?					
Defense Contractors (158)	Not At All	Slightly	Moderately	Greatly	Percent
A. Department of Defense agencies and labs	33	63	44	18	43.2%
B. Non-DoD federal agencies and labs	35	73	42	8	38.2%
Non-Defense Contractors (261)	Not At All	Slightly	Moderately	Greatly	Percent
A. Department of Defense agencies and labs	152	70	35	4	19.4%
B. Non-DoD federal agencies and labs	152	70	35	4	19.4%

6.2 Do Government Procurement Practices Discourage Private Companies?

Question 5 of page 14 asked companies to identify government contracting and procurement practices that discourage them from seeking federal procurement opportunities. The question listed 19 possible explanations labeled from A to T. A blank category labeled U was provided for companies to write-in and evaluate other possibilities. The four options ranged from not at all, slightly, moderately, and greatly.

The following chart presents the company responses to government procurements practices that discourage them from seeking procurement opportunities.

Government Procurement Discouragements (Pg 14-5)

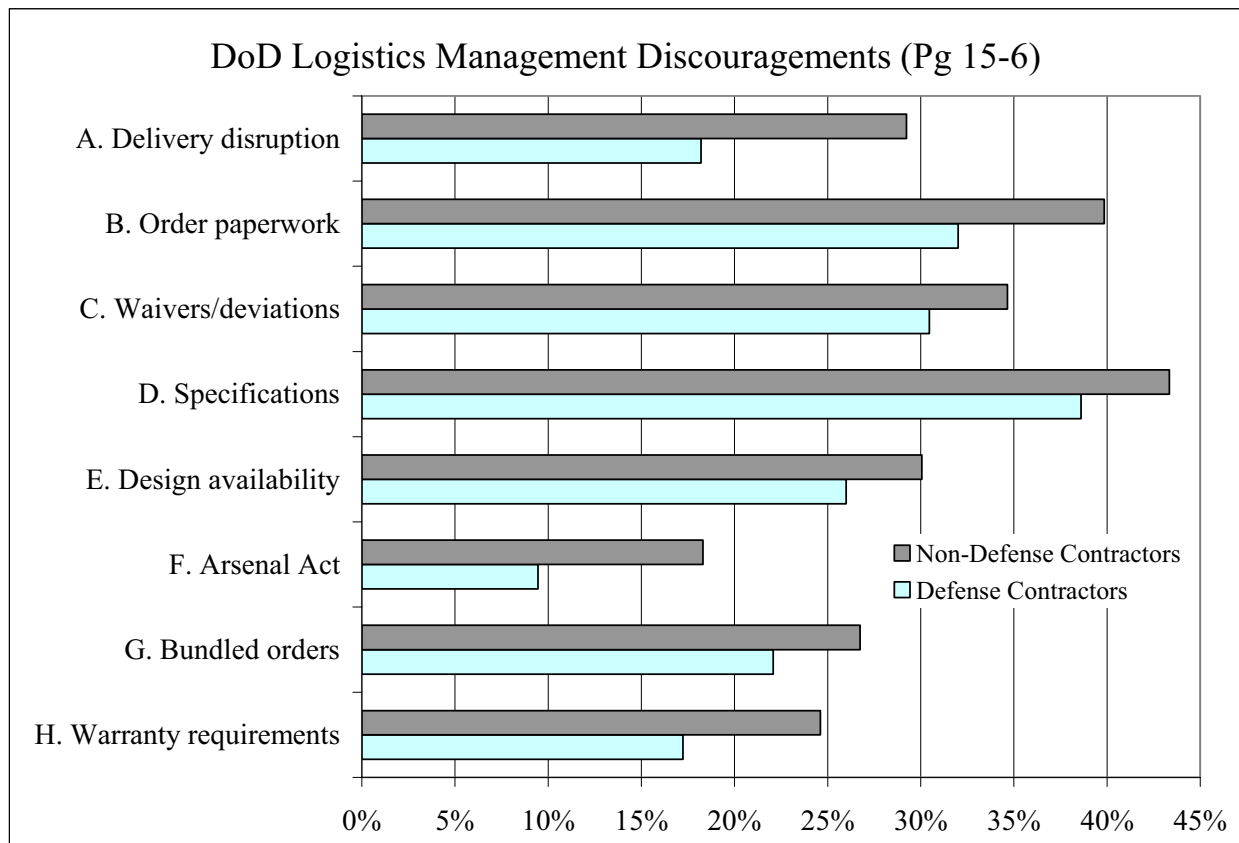


As the table shows, defense contractors were most concerned with the uncertainty and fluctuations of government funding (53.6 percent) and the uncertainty of government demand

(51.8 percent). Non-defense contractors were most concerned with the complexity of solicitations (54.8 percent), uncertainty of government demand (53.3 percent), and narrow payment margins (51.5 percent). Close behind were the costs of bids and proposals (49.5 percent) and uncertainty and fluctuations of government funding (48.5 percent). Write-in comments were predominantly from companies that had no experience or knowledge to make a judgement.

6.3 Company Concerns about defense Logistics Management and the Supply Chain

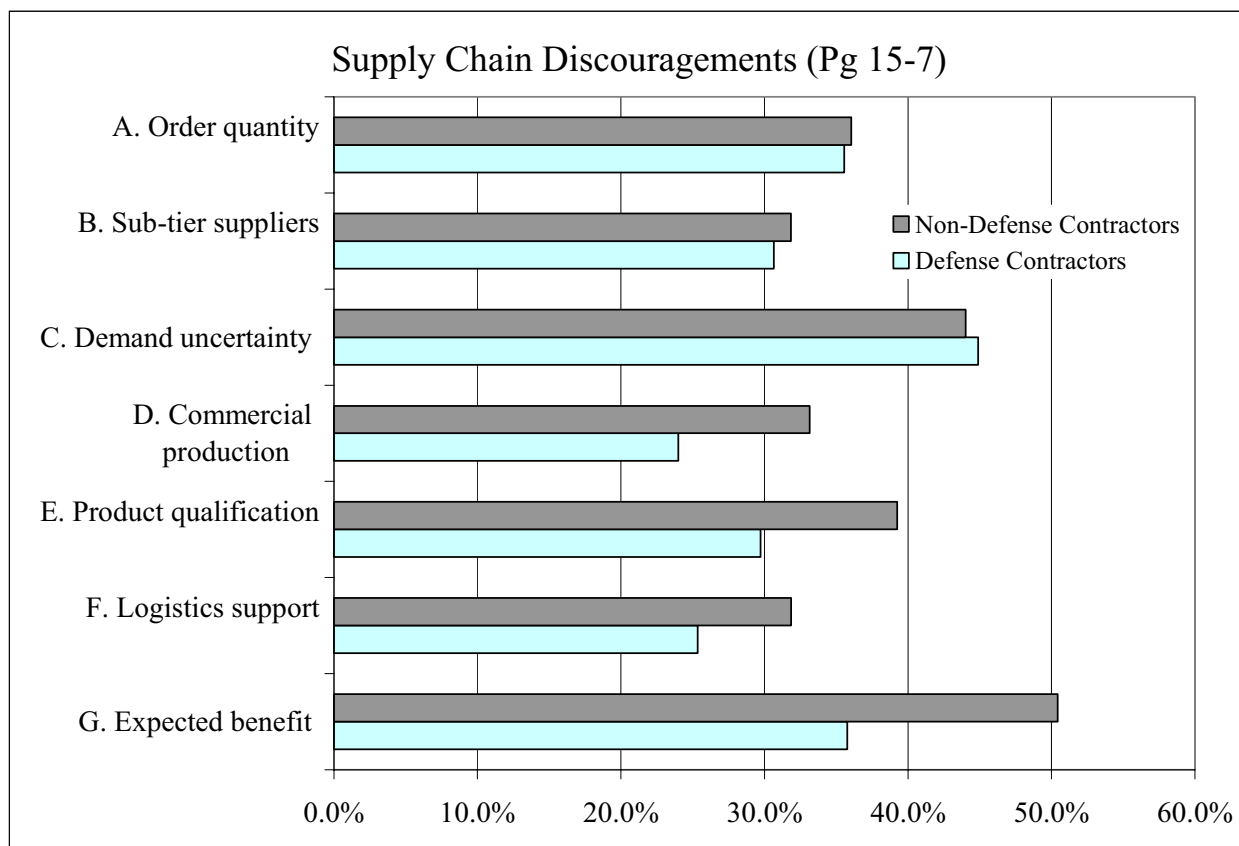
Question 6 on page 15 asked companies to identify the degree to which DoD Logistics Management practices discourage them from doing business with the Department of Defense. The question listed eight possible practices labeled from A to H. A blank category labeled I was provided for companies to write-in and evaluate other possibilities. The four options ranged from not at all, slightly, moderately, and greatly.



As can be gathered from the chart the response to question 6 was rather weak. The strongest concern was specifications for defense items differ from the same commercial product. This was only 43.4 percent, recorded for non-defense contractors. This was also the highest for defense contractors, but at only 38.6 percent. Non-defense contractors recorded 39.9 percent for clearance of paperwork associated with defense orders. This was also second highest for defense contractors (32 percent). Write-ins were from companies with no experience and lack of knowledge.

Question 7 on page 15 asked companies to identify supply chain issues that discourage them from accepting or seeking Department of Defense contracts. The question listed seven possible practices labeled from A to G. A blank category labeled H was provided for companies to write-in and evaluate other possibilities. The four options ranged from not at all, slightly, moderately, and greatly.

Non-defense contractors had the strongest response at 50.4 percent, too costly for expected benefit. The only other response above 40 percent was the uncertainty of demand by both defense and non-defense contractors.

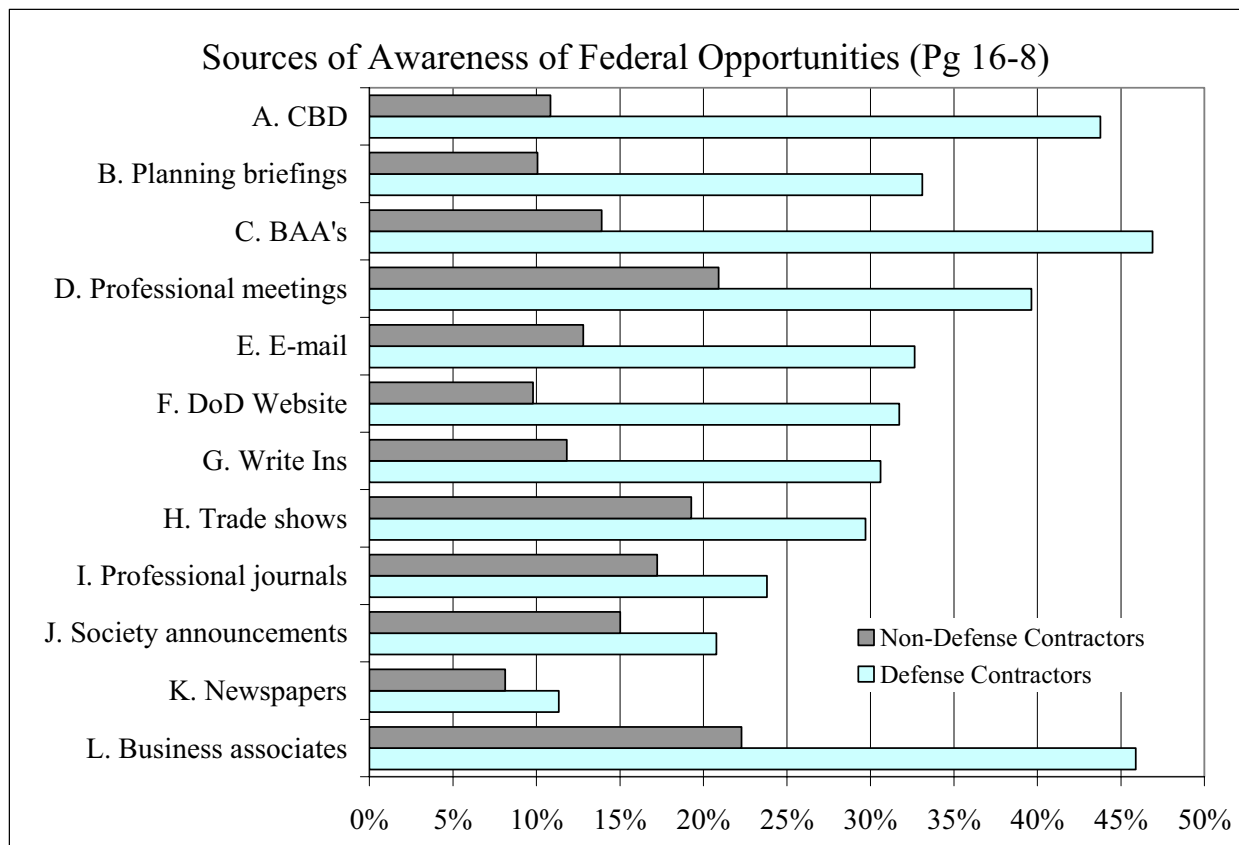


6.4 How Companies Become Aware of Government Opportunities

Question 8 on page 16 asked companies to identify how they most frequently become aware of Defense and non-defense government procurement opportunities. The question listed twelve possible methods labeled from A to L. A blank category labeled M was provided for companies to write-in and evaluate other methods. The four options ranged from not at all, rarely, moderately, and most often.

As might be expected, defense contractors scored higher than non-defense contractors in every category, as communication is an important first step to obtaining contracts. None of the methods, however, were particularly dominant, and all were less than 50 percent. The high was only 46.9 percent, pointing to broad agency announcements. Next was business associate at 45.9 percent, and then Commerce Business Daily at 43.8 percent. The average overall response by defense contractors was 33.1 percent compared with only 14.9 percent by non-defense contractors.

The most frequent response by defense contractors was not at all, which appeared 40.7 percent of the time. Only two-thirds of the non-defense contractors responded, which probably means that only about 10 percent of the companies actually communicate with DoD at all. The not at all answer overwhelmingly dominated the non-defense contractors responses; in fact, for some of the methods nearly 80 percent cited not at all. The following chart presents the results to question 8 on page 16.

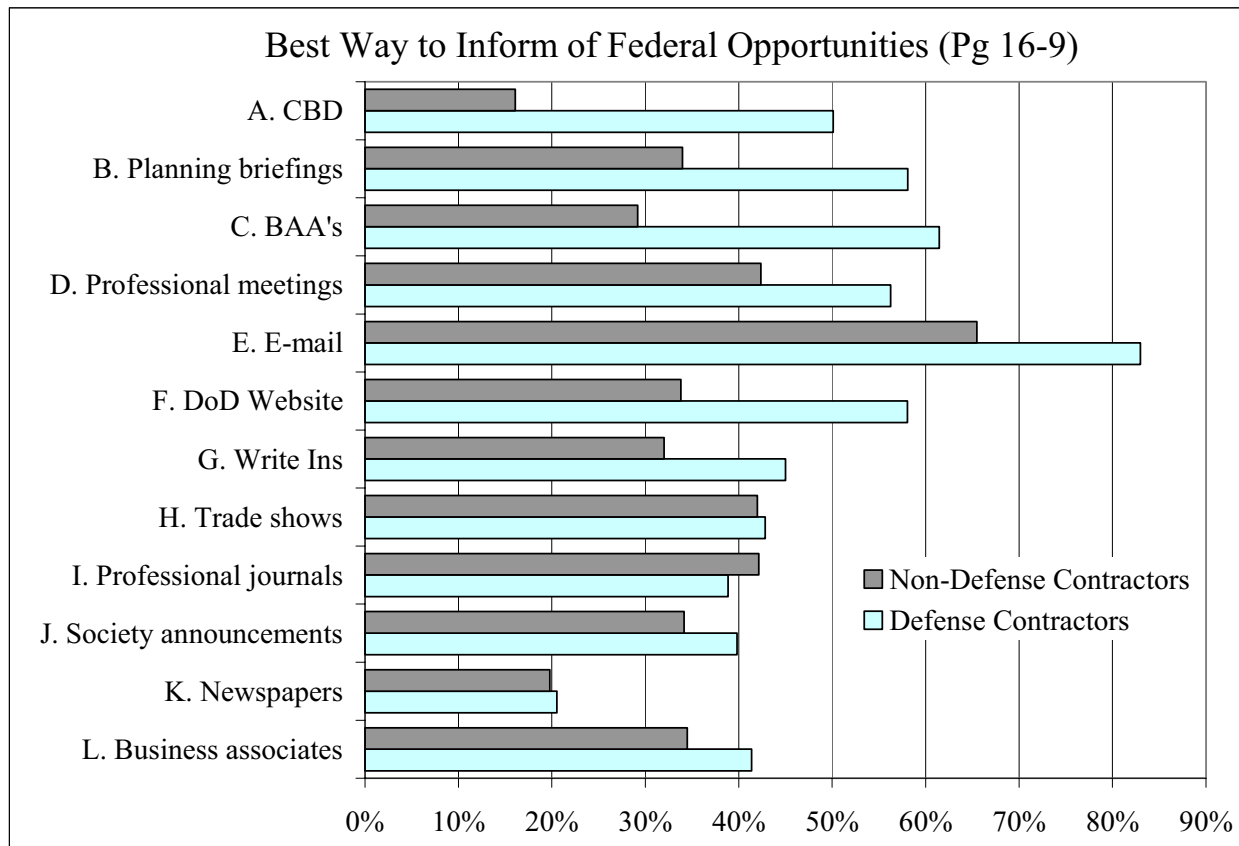


6.5 Methods Government Uses to Inform Companies of Procurement Opportunities

Question 9 of page 16 asked companies to identify the best way to inform them of Defense and non-defense government procurement opportunities. The question listed twelve possible methods labeled from A to L. A blank category labeled M was provided for companies to write-in and evaluate other methods. The four options ranged from not at all, rarely, moderately, and most often.

E-mail distribution was the overwhelming first choice of defense contractors and non-defense contractors alike as the preferred method to learn about federal procurement opportunities. defense contractors registered a very strong 83 percent for the method with 91 of 147 companies answering most often in their response. Non-defense contractors scored 65.5 percent. Defense contractors scored 61.5 percent for broad agency announcements and more than 50 percent for several others. Non-defense contractors registered low percentages for all other methods. About 13 defense contractors and 14 non-defense contractors submitted write-ins. These mentioned

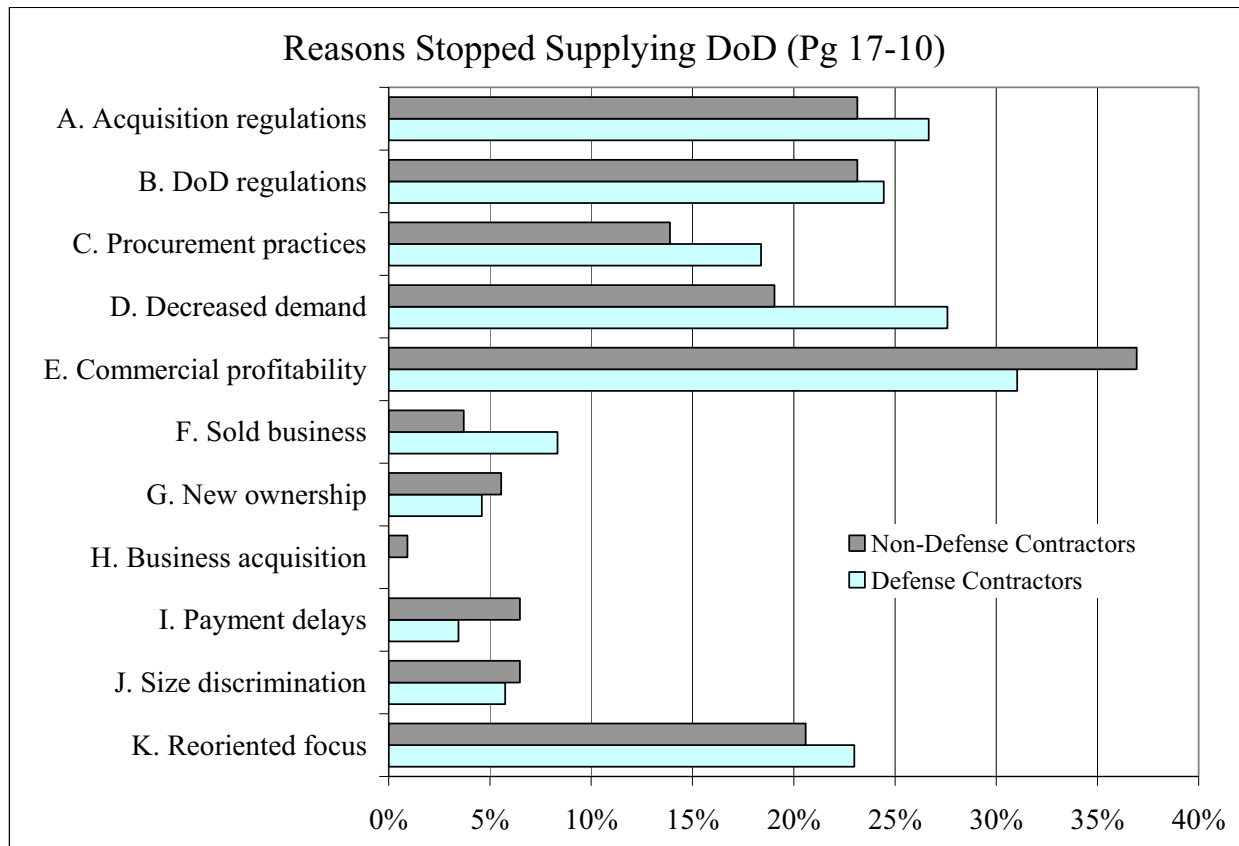
direct mail and telephone contact as additional alternatives. The chart below presents these results.



6.6 Why Some Companies Stopped Supplying DoD

Question 10 on page 17 asked companies to identify reasons they stopped providing goods and services to the Defense Department since 1998. The question listed eleven possible reasons labeled from A to K. A blank category labeled L was provided for companies to write-in and evaluate other methods. The four options ranged from not at all, slightly, moderately, and greatly.

The response to question 10 was very small. Only 29 defense contractors and 36 non-defense contractors responded to the question. In addition, the most commonly checked reason was not at all, which accounted for more than two-thirds of the answers. Keeping this in mind, the high percent reason was that the commercial market was more profitable. This, however, was only 31 percent for defense contractors and 36.9 percent for non-defense contractors. The chart below shows these results.



6.7 Additional Procurement Information

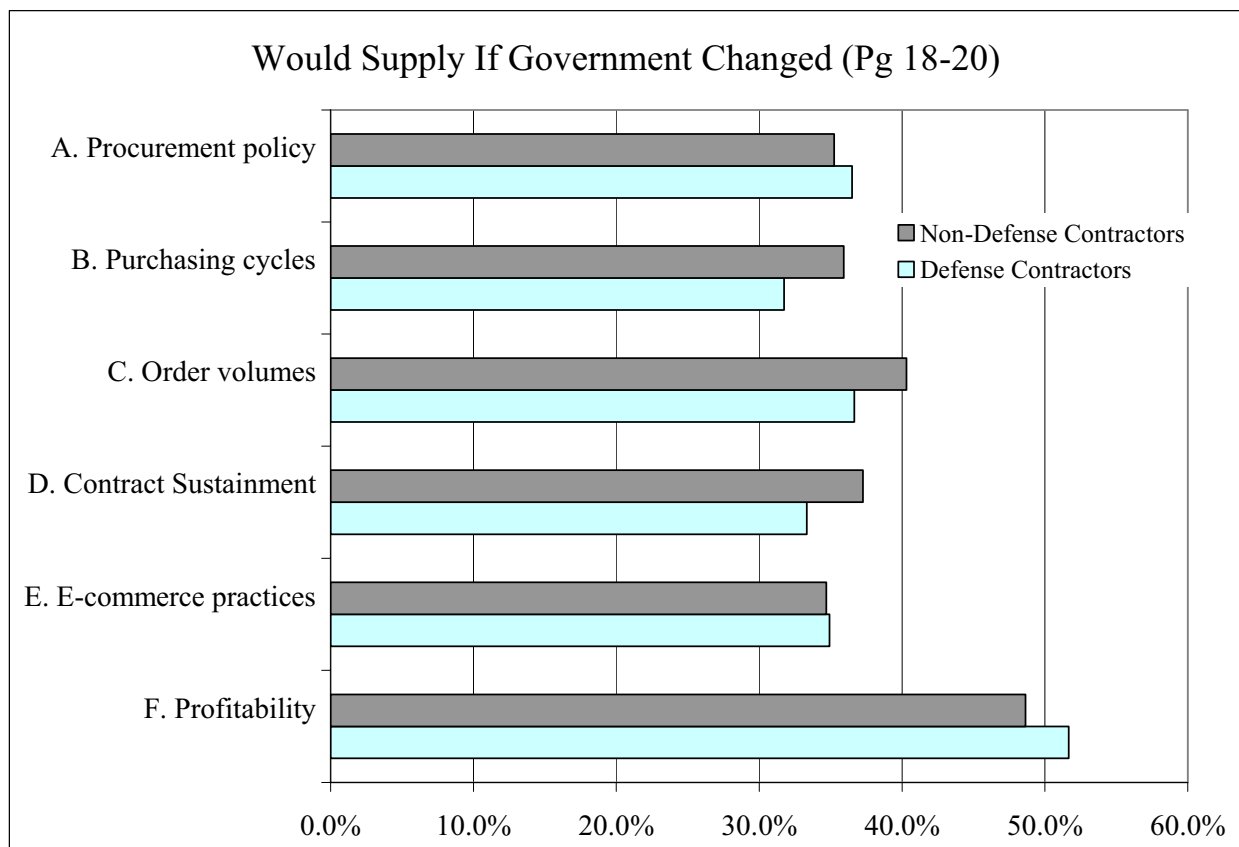
Questions 11 to 19 on page 17 and 18 were yes/no questions that further distinguish the companies in the database between defense and non-defense suppliers. Question 11 was used to determine the major division between defense and non-defense contractors used throughout this report. To restate the results of this question, a total of 158 companies reported they had acted as a prime or a sub-contractor on a DoD contract within the past five years and 269 reported they had not. Responses to this question and the others are shown in the following table.

Defense/Industry Involvement				
	DoD Contractors		Non-DoD Contractors	
Yes/No Questions on Page 17 and 18	Number of Responses	% Yes	Number of Responses	% Yes
11. Has your Business acted as a Prime or a Sub-Contractor on a DoD contract within the past five years?	158	100.0%	269	0.0%
12. If you answered “Yes” to Question 11, did your Business sell product to the Department of Defense as a commercial or non-developmental item?	150	60.0%	7	0.0%
13. Does your Business currently have a defense contract?	157	59.9%	266	1.5%
14. If your Business sells products and services directly to the Department of Defense, are they sold at catalog pricing, i.e., from a published price list?	135	41.5%	91	31.9%
15. Do you have a separate business unit, subdivision, or office that is devoted exclusively to providing R&D services to the federal government?	158	7.6%	263	0.8%
16. Do you have a separate business unit, subdivision, or office that is devoted exclusively to manufacturing products for the federal government?	157	8.9%	262	0.0%
17. Do you use the same employees, facilities and equipment to manufacture commercial and DoD products?	157	93.6%	145	63.4%
18. If your Business sells product directly to the DoD, is the production lead-time quoted the same as quoted to your commercial customers?	124	81.5%	47	76.6%
19. Is your Business registered in Central Contractor Registration (CCR)?	135	74.1%	242	19.0%

6.8 What Would Interest You to Become Supplier Again?

Question 20 on page 18 asked companies to identify reasons they found working with federal government agencies and DoD agencies on R&D, technology development, and engineering in developing new products unproductive. Each question listed five reasons labeled from A to E. A blank category labeled F was provided for companies to write-in and evaluate other reasons. The four options ranged from disagree, slightly agree, agree, strongly agree.

Only 21 defense contractors and close to 200 non-defense contractors responded to this question. Non-defense contractors were strongest in their response to fair practices in purchasing and a fair profit at 48.7 percent. This was also the strongest issue for the few defense contractors that responded. This might indicate a concern that existing defense contractors are too entrenched and difficult to dislodge from the DoD business. The write-ins were submitted mostly by companies not interested in government work. The chart presents these results.



6.9 General Comments

The final page 19 of the survey gave companies the option to write general comments. A total of 173 companies did so. Sixty-two companies were defense contractors, 93 were non-defense contractors, and another 18 were not identified as either. Many of the comments were statements of exemption and many others were clarifications of certain responses to other questions in the survey. A number of companies were upset with being asked to complete the survey when they

considered it did not apply to them. Many others made useful comments. Selected comments are reproduced here.

6.9.1 Defense Contractors

1. This survey was mostly not applicable to our operations. We make no finished goods. We sell raw materials to plastics industry. Other manufacturers make end products. Once in a great while we might supply product for a customer who is using our product in a DoD application.
2. Most of the survey does not apply to our company. We are a manufacturing company and do not perform R&D on any regular basis.
3. Government contracts tend to be limited in quantity releases, indefinite deliveries, etc. which for small companies makes it hard to be economical in buying materials and components. My company tends to release only small quantities at a time due to limited funds, thereby putting small businesses at a disadvantage.
4. The government acquisition needs to focus on Best Value efforts and Buying Practices. The small gross profits on particular contracts do not make it economically feasible to operate a business, particularly on FFP contracts.
5. Ready, willing and able to accept government contracts. However, since our manufacturing is based in Germany, this has become difficult.
6. Our company was founded to sell products to DoD. Today, we only support a small amount of old military spare parts. We would be interested in working with the Government but we don't see a clear financial return.
7. In general DoD does not often contract for components on a multi-year basis like most commercial firms. Budget constraints cause many delays in funding, which impacts a supplier. The escalation of costs is not fully recoverable.
8. This survey should have been sent to business leaders instead of engineers. I am an individual contributor for design and analysis rather than business development. Therefore, this survey has been answered with my very limited knowledge of the business field.
9. Conducting business with the federal government generally requires employees with extensive experience in this area to be successful. As a small company, funding specialized resources for an area that has such long sales cycles and smaller profit margins is difficult. Only now that we have grown to a sufficient size are we now able to begin adding these resources and are beginning to reach the government market.
10. We do very little contracting with any branch of the government. Therefore, we have an extremely small knowledge of the various programs for research and the like.

6.9.2 Non-Defense Contractors

1. My company serves the metal casting industry...primarily patternmakers, mould makers and plastic tool builders. We have not solicited the U.S. government for business mainly because of paperwork complexity and supplier qualification requirements.
2. Is there a document available that explains the how to, where to, and what to regarding government business? Is there an easy way to find sorted opportunities to bid on instead of looking for a needle in a haystack?
3. This survey has little to do with the fine and specialty chemical business of my company. Our only interaction is the production of anhydrides which are subsequently used by other companies for the possible production of composite materials.
4. Although everyone at my company loves their country, the political and social agendas embedded into the federal contract and procurement process along with the incessant volumes of bureaucratic record keeping make it impossible for us to seek business with the government. We would love to sell plastics to the government if it behaved like an ordinary customer. This would be the same for joint development efforts if they were ordinary business relationships. Unfortunately, we are not resourced properly to participate as things stand today. This survey may be the starting point to turn this situation around.
5. This was very difficult to complete due to the fact that the longest portion of our internal R&D is done by our Swiss parent company overseas. I answered these questions with data from our US department to the best of my ability. We do virtually no R&D here in the states.
6. It is hard to answer questions about the DoD because we've never thought much about opportunities with the DoD. We did have two men from the DoD stop in and review our operations just to familiarize themselves with our capabilities and how they may apply. I can't make much comment because I can't pass judgment in many of these areas. We haven't worked with the federal Government, so I don't know how hard or easy it may be.
7. My company's engineering resins would provide products for government contracts, but we are not aware of any government applications that would utilize our nylon and pet resin compounds.
8. My company has only provided test material to NASA. We have never done any other business with the DoD. We do not have an R&D function. That is why "N/A" is used as an answer on several questions. We are willing to look at future defense projects and are willing to share our knowledge.
9. Since our business centers around converting synthetic fibers into short cut lengths, we do not perform much R&D work on the end fiber products. Instead, our R&D and design & engineering is focused on improving our production machinery and production processes.
10. Most of this survey does not apply to this company. We have never worked with the US government. Our R&D is strictly for internal use.

11. We have no experience (to the best of my knowledge) dealing with DoD or non-DoD agencies for the last 50+ years. I could not accurately answer most questions without more information and/or experience.
12. As a custom plastics manufacturer, we are not involved in pure research. We can however offer our engineering and manufacturing experience and expertise in producing complex, difficult to mold, products thus offering economic and performance improvements.
13. We have no interest in doing business with the federal government.
14. Most questions not answered because we have no experience in the given field.
15. My company wishes to focus 100% on the commercial market.
16. My company holds or has pending patents on some of the most compelling technology in the power electronics industry. Certainly this technology could benefit DoD or other federal agencies. We will be presenting a professional advancement course on some of these developments at Power Systems World in October 2002. If we can be of service and we can be paid for that service we would have an interest in doing business with the government.
17. I found that filling out this survey was a great waste of time.
18. My company is a commercial manufacturer of vacuum and flow instrumentation. We fund our own R&D. We occasionally sell our products to DoD and other government agencies under our commercial terms and conditions at published catalogue spec.'s and prices. We will build special products for DoD and other government agencies if contacted by them directly, but only under our commercial terms and conditions.
19. We have no interest in government contracts therefore this questionnaire is irrelevant. Why don't you have this as an exemption up front?
20. No incentive to share R&D without near term revenue.
21. I have no experience with the DoD and therefore cannot answer the majority of questions.
22. We would love to do business with the U.S. Government, but we are a small company. The government seems to only award contracts to big companies. We are a low cost manufacturer and our R&D is spent on machines we make ourselves to improve quality, cost and efficiency.
23. My company is a state-of-the-art startup company. Funding and policies to favor/ease market entry are the areas that would interest us the most. We are selling the future of high-speed internet access, voicemail communications and video transmission. Government policies and laws to nurture and aid in the viability of our efforts are most welcomed.
24. My company is interested in collaborating with DoD in R&D areas that are aligned with its business objectives. The empowerment of DoD research laboratories to select their own research partners can increase the participation of companies like ours in DoD R&D.
25. Our company's last DoD contract was with LLNL about 10 years ago. We worked on a proposal for about 18 months for a DoD subcontract from a major prime contractor, expending about \$100,000 and did not win the job. Proposal efforts seem MUCH too

expensive and involved... we made the decision to focus on commercial and industrial business instead of government.

26. We are a very small company and do not provide R&D services for any other organizations, just for our own product development