

National Economic Impacts from DoD License Agreements With U.S. Industry

2000-2014



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TechLink and University of Colorado Business Research Division

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EXECUTIVE SUMMARY

This study quantifies the overall **contributions of Department of Defense (DoD) license agreements to the nation's economy and defense mission**. U.S. government agencies have a legislative mandate to transfer their patented inventions to industry. Patent license agreements are used to transfer these inventions. License agreements enable companies to develop and sell new products and services using these inventions.

In 2015, an independent research team undertook a yearlong study of the economic impacts from DoD license agreements with U.S. industry. The study's primary purpose was to determine the extent to which DoD license agreements active during the 2000-2014 period contributed to **new economic activity and job creation** in the United States. A secondary purpose was to estimate the extent to which these license agreements resulted in the **transition of new technology to U.S. military use**. This study was undertaken at the direction of the Air Force Technology Transfer Program and the Defense Laboratories Office within the Office of the Assistant Secretary of Defense for Research & Engineering.

The research team surveyed all 602 companies with DoD license agreements active during the 2000-2014 period. Companies were asked to divulge the total sales of new products and services and other economic outcomes directly related to their license agreements. They were also asked about related economic outcomes, including sales to the U.S. military, follow-on research and development contracts, sublicensing revenue, and sales by sublicensees and spin-out companies.

The response rate was very high—92 percent of the companies that the research team was able to contact participated in the study. The team was able to obtain full or partial information on the economic outcomes of 663 out of the 733 total DoD license agreements (90 percent). IMPLAN economic impact assessment software was used to estimate the economic impacts related to the sales and other economic outcomes from these agreements.

Study results are believed to significantly understate the actual economic impacts because of non-responding companies, the effects of inflation, and other factors analyzed in the report.

Major findings from the study included the following:

- **\$20.4 billion in total sales** of new products and services resulting from the DoD license agreements
- **\$3.4 billion** in sales of new products to the U.S. military
- **\$48.8 billion in total economic output** nationwide
- **\$1.6 billion** in new tax revenues (federal, state, and local)
- **182,985 full-time jobs** created or retained
- **12,199 full-time jobs per year** with an **average salary of \$71,337**



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PURPOSE OF STUDY

U.S. government agencies have a federal legislative mandate to transfer their inventions to the private sector in order to benefit the nation's economy.¹ Patent license agreements are used to transfer these inventions to industry. License agreements enable companies to develop and sell new products and services using these inventions.

This study was undertaken to estimate the contribution to the national economy of license agreements transferring Department of Defense (DoD) inventions to industry. The study's purpose was to determine the extent to which these license agreements have (1) contributed to new economic activity and job creation in the United States, and (2) resulted in the transition of new technology to U.S. military use. The period covered by the study was 2000-2014.²

The study was undertaken in two major phases. First, the research team surveyed all companies having active license agreements with DoD during the 2000-2014 period—a total of 602 companies with 733 different agreements. Companies contacted were asked to divulge the total sales of new products and services directly related to their DoD license agreements. Second, the research team used IMPLAN economic impact assessment software to estimate the total economic impacts related to these sales. IMPLAN is a leading program used by more than 1,500 organizations nationwide to model economic impacts. Analysis included estimates of economic output, value added, employment, labor income, and tax revenues.

RESEARCH TEAM

TechLink, a DoD-funded technology transfer center at Montana State University, conducted this economic impact study in collaboration with the Business Research Division (BRD) of the Leeds School of Business at the University of Colorado Boulder. Since 1999, TechLink has served as DoD's primary national "partnership intermediary," helping to develop technology transfer partnerships between DoD laboratories and U.S. industry nationwide. TechLink's primary

focus is facilitating the transfer of patented inventions from DoD labs to U.S. companies through license agreements. TechLink currently brokers or facilitates approximately 60 percent of all DoD license agreements with industry. These license agreements enable companies to develop, manufacture, and sell new products and services using DoD inventions.³ This benefits the national economy and also supports the U.S. defense mission.

¹ 15 U.S.C. 3701 and 3710, *inter alia*

² This study is an update of a previous study completed in 2013: *National Economic Impacts from DoD License Agreements with U.S. Industry, 2000-2011*, available at: <http://techlinkcenter.org/articles/2013-report-economic-impact-dod-invention-licensing>

³ For more information, see www.techlinkcenter.org



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The BRD has been analyzing local, state, and national economies for more than 95 years. It specializes in customized research and economic impact studies that help companies, associations, nonprofits, and government agencies make informed business and policy decisions.⁴ The BRD has conducted economic impact studies for a wide range of clients, including the National Renewable Energy Laboratory, Xcel Energy, Western Union, the American Petroleum Institute, and CO-LABS, a consortium of federally funded scientific laboratories, universities, businesses, and local governments in Colorado.

With TechLink, the BRD has previously conducted two national economic impact studies focusing on DoD small business innovation research and technology transfer programs. The first study

examined the economic impacts from all Air Force SBIR/STTR Phase II projects completed during the 2000-2013 period—a total Air Force investment of approximately \$4 billion.⁵ The second study focused on the economic impacts from all TechLink-facilitated technology transfer agreements active during the 2000-2014 period. This latter study was an update of previous studies conducted in 2009 and 2012. The current study is the sixth major economic impact study undertaken by TechLink.⁶

The principal authors of this study were Dr. Will Swearingen of TechLink and Brian Lewandowski of the BRD. Other key members of the research team were Phillip Luebke, Andrew Schoneberg, Chris Huvaere, and Kirkwood Donavin of TechLink, and Dr. Richard Wobbekind of the BRD.



⁴ For more information, see www.colorado.edu/leeds/centers/business-research-division

⁵ The Air Force SBIR/STTR Program economic impact study is available at: <http://static.techlinkcenter.org/techlinkcenter.org/files/economic-impacts/USAF%20SBIR-STTR%20Economic%20Impact%20Study%20FY2015.pdf>. SBIR and STTR are acronyms respectively for Small Business Innovation Research and Small Business Technology Transfer.

⁶ All of these studies are available online at <http://techlinkcenter.org/economic-impacts>



METHODOLOGY

DATA GATHERING

To undertake this study, TechLink first assembled essential information on all DoD license agreements active during the 2000-2014 period. This information came from two different sources: (1) TechLink itself, for license agreements that it had brokered or facilitated between DoD labs and industry; and (2) DoD labs, for agreements they had established independently of TechLink assistance. A total of 733 license agreements were included in the study. TechLink provided information on 366 of these agreements and the DoD labs on the remaining 367 agreements. The study included license agreements from 65 different DoD laboratories.

The information gathered for each agreement included the name of the company that had licensed the DoD technology, contact information for the company's designated point person, the patent number(s) or a short description of the licensed technology, and the effective dates of the agreement.

Two TechLink economic research specialists used this information to contact each of the companies involved. A total of 602 companies were contacted by email and telephone about the outcomes of their 733 license agreements with DoD. The number of agreements exceeds the number of companies because a sizeable subset of companies (94, or 15 percent) had two or more license agreements with DoD. Of this group, 18 companies had three or more agreements, including one company with 13 different agreements.

602
companies surveyed

92%
of companies contacted
provided information

663
license agreements
with known results



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Survey Questions

Companies were asked a series of questions that focused on the economic outcomes related to their license agreements with DoD. They were informed that all economic and financial information that they provided to TechLink would be kept entirely confidential and would only be aggregated with the information from other companies in the study, and not shared with any other entity, including DoD.

Questions asked included the following:

1. Did your company develop any new products or services based on the license agreement, including improvements to existing products or services?
2. What were the total cumulative sales of new or improved products or services related to this license agreement?
3. Of the total sales, what was the dollar value of sales to the U.S. military, either directly or through a prime contractor?
4. In addition to sales of products and services, did the agreement lead to any follow-on R&D contracts for further development of the licensed technology? If so, what was the dollar value of those contracts?⁷
5. Did you sublicense the technology to other companies? If so, what were the total royalties received from the sublicensees? What are the names of the licensees, so we can follow up to ask them about their sales?
6. Did you create a start-up or spin-out company to commercialize the licensed technology? If so, what is the name of the company, so we can follow up to ask them about their sales?
7. Did you receive any significant investment funding, such as venture capital or angel funding, directly related to the licensed technology?

Response Rate

The research team was able to obtain definitive information on the outcomes of 620 license agreements out of the 733 total. Partial economic information on an additional 43 licenses was gathered through non-survey methods, described below. In total, the research team obtained economic information on slightly over 90 percent of the DoD license agreements. Combined, these 663 licenses were used to estimate the economic impact of the DoD licensing program.

The company response rate was also very high. Only 50 of the 602 companies surveyed declined to participate in the study, either explicitly or by ignoring repeated telephone calls and email messages. Ninety-two (92) percent of the companies contacted agreed to provide sales and other economic information.

However, 32 companies could not be contacted because they had ceased to operate as corporate entities. They had either gone out of business, changed their names, or been acquired by other companies. With these companies added to those that declined to respond, the company response rate for the study was around 86 percent, still very high for these types of studies.

⁷ Contracts for further development of a technology were treated as sales of R&D services and were included in the total sales.



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The primary reasons for the study's high response rates were believed to be the following:

- Clear communication about the purpose and legitimacy of the study. Companies were informed that the study's purpose was to quantify the extent to which DoD-developed inventions licensed to industry were having a positive impact on the national economy and U.S. defense mission. Companies that questioned the legitimacy of the study were sent a letter from the Director of the Defense Laboratories Enterprise in the Office of the Assistant Secretary of Defense for Research & Engineering that explained the purpose, confidential nature, and importance of the study as well as TechLink's role in undertaking it.
- Strong assurance that company-specific information would be kept confidential. Companies were assured that the DoD was only interested in the overall economic impacts from its licensing agreements with industry—not in company-specific results. Most companies consider their sales figures to be confidential, proprietary, or business-sensitive. Without the assurance that all responses would be treated as confidential information, few companies would have been willing to divulge their sales information.
- Conciseness of the survey. The survey questions were few in number and relatively easy to answer. In many cases, the research team was able to secure the necessary information over the telephone on the first contact. More commonly, extensive follow-up by phone and email was required, often involving several different company personnel. However, the conciseness of the survey encouraged participation.

- Persistence by the TechLink economic research specialists. Some companies were contacted more than a dozen times by email or telephone in the attempt to get through to the right person and obtain the necessary information. This dogged persistence was a key factor behind the high response rate.

In several cases involving non-responding companies, the TechLink team was able to get at least partial sales information through secondary research. Internet searches of specific non-responding company names sometimes led to press releases and other announcements of contracts awarded to these companies—contracts typically for sales to the U.S. military. When these announcements were discovered, the research team undertook further research to determine whether the contracts involved products based on the technology licensed from DoD.

Web sites that document U.S. government contracts were useful when the licensed technologies were primarily commercialized for sales to the U.S. military or other U.S. government agencies. Government sites consulted included: (1) USAspending.gov, the website of the Office of Management and Budget (OMB), which provides searchable information on all federal contracts awarded (<https://www.usaspending.gov>); (2) DIBBS, the Defense Logistics Agency (DLA) Internet Bid Board System, which provides information on all DLA awards to industry (<https://www.dibbs.bsm.dla.mil>); and (3) the Federal Procurement Data System, a central repository of information on government-wide contracts maintained by the General Service Administration (<https://www.fpds.gov>).



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Commercial sites consulted for U.S. government sales included: (1) Government Contracts Won, which lists awards to thousands of different defense contractors, large and small (www.governmentcontractswon.com); (2) BidLink, which enables searches of procurement history by the National Stock Numbers (NSNs) that are used to order specific military products (www.bidlink.net); and (3) PartsLogistics, which also allows government contracts to be searched by NSNs (www.partslogistics.com). Usually, searches of several of these sites were needed to piece together at least a partial history of the U.S. government sales by specific non-responding licensees of DoD inventions.⁸

In a few cases involving large publicly traded companies that declined to participate in the study, the research team was able to obtain highly accurate sales information on major products derived from DoD inventions by reviewing these companies' online annual reports. These cases comprised some of the largest sales in the study and were focused primarily on the civilian marketplace. In several cases involving non-responding defense contractors, a search of the annual DoD budgets was productive. These budgets, available online, provided often-detailed information on major acquisition contracts for defense-related products that were based on the licensed DoD inventions. Similarly, in several cases in which defense contractors had large contracts from foreign governments for defense-related products embodying the DoD inventions, the research team was able to find records of these sales in DoD reports to Congress.⁹

NAICS Code Assignments

TechLink next assigned each company to the appropriate North American Industry Classification System (NAICS) code for the product or service resulting from its license agreement. This was an essential step for analysis of the overall economic impacts. NAICS codes are one of the most important inputs to the economic impact model, IMPLAN (described below), because they are used to accurately determine the economic multipliers specific to the particular industrial activity.

NAICS is the U.S. federal government's standard industry classification system. It is a comprehensive production-oriented system that groups companies into industries based on the activities in which they are primarily engaged. NAICS recognizes 1,065 different industries in the United States and assigns a unique code to each industry. Some of the companies in this study with multiple license agreements were assigned to more than one NAICS code, depending on the associated product or service.

To identify the appropriate NAICS codes, multiple sources were referenced, including Hoover's (www.hoovers.com), the LexisNexis Academic web site (www.lexisnexis.com), a commercial NAICS-related website (www.naics.com) that provides a convenient system for looking up NAICS codes by industry sectors and subsectors, and the federal System for Award Management (www.sam.gov), which contains NAICS codes self-identified by the companies.

⁸ For example, see the following fiscal year 2016 budget justification from the Army: <http://asafm.army.mil/9/Documents/OfficeDocuments/Budget/budgetmaterials/fy16/rforms//vol2.pdf>

⁹ The U.S. Congress requires annual reports on all major "foreign military sales" and "direct commercial sales" of defense-related technology. These are found at the website of the Defense Procurement and Acquisition Policy (DPAP) Contract Policy and International Contracting (CPIC) Directorate: http://www.acq.osd.mil/dpap/cpic/cp/congressional_reports.html



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For businesses not listed on these sites, the classification tree at the official U.S. government's NAICS code website (<http://www.census.gov/eos/www/naics/>) was compared to activity reported by the companies in their interviews with the TechLink team to arrive at the appropriate NAICS codes.

The TechLink research team entered company sales and other economic data and NAICS code information into the custom database developed for this study. The database greatly facilitated data entry from the economic research specialists gathering company information. Once the data were aggregated and carefully validated by the team, the database provided mechanisms for quickly querying and analyzing the data as well as generating a final dataset for economic impact modeling.

TechLink subsequently submitted the final dataset to the Business Research Division at the

Leeds School of Business, University of Colorado Boulder. Among other information, this dataset included—for each license agreement—a code number to identify the agreement and conceal the company's name, the 6-digit NAICS code for the corresponding product or service, and the total sales figures.

For the purposes of this study, the following economic outcomes were regarded as “company sales” and, together, comprised the “total sales:” (1) all sales of new products and services directly related to the licensed DoD technologies, including both commercial and military sales; (2) follow-on R&D contracts to further develop these technologies for specific applications (defined as sales of R&D services); (3) royalties from sublicensing the licensed DoD technologies; (4) sublicensee sales of the licensed technologies; and (5) sales of products or services embodying the licensed technologies by start-up or spin-out companies.





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DATA ANALYSIS

The BRD employed a widely used economic impact analysis software program, IMPLAN, to estimate the economic contribution effects of the total sales resulting from the DoD license agreements. More than 1,500 entities in academia, the private sector, and government use IMPLAN to model economic impacts. It is employed to determine economic impacts on regions ranging in size from zip code area to county, state, and national levels (www.implan.com).

IMPLAN draws on a mathematical input-output framework originally developed by Wassily Leontief, the 1973 Nobel laureate in economics, to study the flow of money through a regional economy. IMPLAN assumes fixed relationships between producers and their suppliers, based on demand, and that inter-industry relationships within a given region's economy largely determine how that economy responds to change. Increases in demand for a certain product or service causes a multiplier effect—a cascade of ripples through the economy. This increased demand affects the producer of the product, the producer's employees, the producer's suppliers, the supplier's employees, and others, ultimately generating a total impact on the economy that significantly exceeds the initial change in demand.

For example, Company X licenses a patented laser invention from the Air Force Research Laboratory. It then develops an improved barcode scanner using this technology, which it manufactures and sells nationwide.

This requires Company X to hire factory workers, who spend their payroll checks on groceries and other goods. In addition, Company X has to purchase components and raw materials from other companies, which also employ workers who purchase groceries and other goods, and so on.

In this example, direct effects are the result of the sales of the new barcode scanner based on the Air Force technology. Indirect effects are the result of the inter-industry purchases of components and raw materials needed to manufacture the barcode scanner. Induced effects are the result of the household expenditures as workers spend their payroll checks on goods and services across a wide spectrum of the economy. Economic impacts are the sum of direct effects, indirect effects, and induced effects.

Multipliers are the ratio of the overall economic impact to the initial change and are typically derived from the following equation: $(\text{direct effect} + \text{indirect effect} + \text{induced effect}) / \text{direct effect}$. Multipliers are very specific to industry sectors and regions. IMPLAN uses NAICS codes to distinguish between 536 industry sectors recognized by the U.S. Department of Commerce. Each sector has a unique output multiplier because it has a different pattern of purchases from firms inside and outside of the U.S. economy. Each year, IMPLAN is updated using data collected by various federal government agencies.



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In this study, the BRD applied the national-level IMPLAN model to the total sales figures reported by the companies surveyed. As previously indicated, these figures represented all sales of products and services related to the DoD license agreements active during the 2000-2014 period. Using IMPLAN, the BRD was able to estimate the sum of the direct, indirect, and induced effects of these sales. The overall purpose of this modeling exercise was to estimate the total economic contribution of these sales to the nation's economy, including total economic output, value added, employment, labor income, and tax revenues.

Data presented are for the year 2014 accounting period and expressed in 2014 dollars. The large majority of the company sales occurred prior to 2014 and some date back to the early 2000s. However, most of these sales are ongoing and there was a need to standardize the year. Use of 2014 as the reference year represents a conservative approach because it does not consider the relatively higher value of the earlier sales figures due to inflation (e.g., a dollar in 2000 was worth 37 percent more than a dollar in 2014).





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RESULTS

SALES FROM DoD LICENSE AGREEMENTS

Nearly half of the DoD license agreements successfully resulted in commercialization, with many others still in the commercialization process. Companies reported that 353 of the 733 license agreements in the study (48 percent) had generated sales of products or services or other revenues. These agreements involved licensed technologies from 55 different DoD laboratories nationwide.

The data revealed that DoD license agreements generated **total cumulative sales** of slightly over **\$20.4 billion**, or \$20,442,227,211 (see Table 1).

As previously mentioned, the “total sales” category included all of the following sources of revenue from commercialization of the licensed DoD technologies:

- Sales of new products and services, including both commercial (civilian) sales and sales to the U.S. military
- Follow-on R&D contracts to further develop the DoD technologies for specific applications, which were defined as sales of R&D services
- Royalties from sublicensees of the licensed technologies
- Sublicensee sales of the licensed technologies, when this information could be obtained
- Sales by spin-out or start-up companies, when this information was available.

Table 1. Sales resulting from DoD license agreements, 2000-2014

	Total Companies	Total Agreements	Percent of Total Agreements	Total Sales
Included in Study	602	733	100	\$20.4 Billion
Achieving Sales	294	353	48	\$20.4 Billion
No Sales	262	310	42	--
No Response ¹⁰	46	70	10	--

Source: Cumulative sales reported by companies to TechLink, Montana State University, during survey from January to September 2015.

¹⁰ The “No Response” category excludes license agreements for which information was gathered from non-survey sources.



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Companies reported that 310 license agreements (42 percent) had not generated sales or other revenues. This category included (1) newer agreements involving technologies that companies were still actively engaged in commercializing, and (2) agreements that, for many different reasons, had not resulted in commercialization and had been abandoned. A total of 113 agreements involved companies from which the research team was unable to obtain information. These companies either were unwilling to participate (72 agreements) or were uncontactable (41 agreements). As previously mentioned, for 43 of these agreements, information that was useful to this economic impact study was acquired through secondary, non-survey sources (leaving 70 agreements about which no information was acquired).

Table 2 shows the total cumulative sales from the DoD license agreements (\$20,442,227,211), broken down by sales category. As this table shows, **commercial (civilian) product and service sales** totaled nearly \$15.7 billion (\$15,650,123,126) and accounted for 77 percent of the total sales. **Military product and service sales** were nearly \$3.4 billion (\$3,432,347,974) and constituted 17 percent of the total.

R&D contracts to further develop the licensed technologies accounted for around \$869 million (\$868,509,903). These contracts were considered sales of R&D services and came from both the government and private sectors. For example,

a small biotech company that licensed some promising infectious disease antibodies from an Army medical lab may have received substantial funding from the National Institutes of Health to help develop a diagnostic test for the disease as well as funding from a major pharmaceutical company to develop a vaccine or therapeutic product. These R&D contracts accounted for around 4 percent of the total sales. The remaining 2 percent of the total sales consisted of **royalties from sublicensees** (\$41,791,231), **sales by sublicensees** (\$443,354,977), and **sales by spin-out companies** (\$6,100,000).





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Table 2. Sales from DoD license agreements, by sales category, 2000-2014

Sales Category	Total Sales \$ Millions	Percent of Total
Commercial Product/Service Sales	\$15,650	77
Military Product/Service Sales	\$3,432	17
R&D Contracts	\$869	4
Royalties from Sublicensees	\$42	0.2
Sales by Sublicensees	\$443	2
Sales by Spin-out Companies	\$6	--
Total Combined Sales	\$20,442	100

Source: Cumulative sales reported by companies to TechLink, Montana State University, during survey from January to September 2015.

Remarkably, a single license agreement accounted for approximately \$14.1 billion of the sales from DoD license agreements—around 69 percent. This was a license for a respiratory syncytial virus (RSV) antibody from the Uniformed Services University of the Health Sciences (USUHS). The antibody is used in a top-selling drug, Synagis, to prevent serious lower respiratory tract disease in infants and young children. Without this top-selling drug, total sales were slightly over \$6.3 billion.

Total sales from the single USUHS license agreement were nearly 16 times larger than those from the second most successful license agreement, which generated almost \$900 million in sales. Only 14 agreements generated more than \$100 million in sales; however, 61 agreements had sales of at least

\$10 million. Notably, 178 license agreements generated sales of at least \$1 million—approximately 24 percent.

Including all 663 license agreements for which sales information was obtained, the average agreement generated around \$31 million in sales. Excluding sales of Synagis, the average figure was around \$8.7 million. Among just the 353 license agreements with sales, the average figure was nearly \$20.6 million (not counting sales of Synagis). Among all agreements with sales, the median sales figure was approximately \$1.5 million.



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Military Sales

As noted, the survey found that sales to the U.S. military amounted to slightly over \$3.4 billion, which was approximately 17 percent of the total sales. However, excluding Synagis, U.S. military sales accounted for nearly 54 percent of total sales. This high percentage is a very positive finding from the DoD perspective. It demonstrates that, via technology transfer, the DoD R&D system is achieving its objective of developing new technology to support the U.S. defense mission.

Some of the companies surveyed had primarily military sales. While companies do not need license agreements to manufacture products based on DoD-patented inventions for U.S. government use, they obtain licenses because they hope to make commercial or foreign military sales. It is ideal when there are both commercial and military markets for new technologies, because DoD benefits from production economies of scale that help reduce the cost of new defense-related products. In addition, having a commercial marketplace helps ensure the ongoing development of the new technologies and also sustains production in between the spikes of military demand. Frequently, the commercial market is substantially larger than the military market for dual-use civilian/military products.

Sales by Company Size

A notable survey finding concerned company size. A common assumption is that large corporations, particularly large defense contractors, are the primary DoD technology transfer partners. However, this study determined that large

corporations (with 500 or more employees) accounted for only 17 percent of all licenses achieving sales from their DoD license agreements. Small businesses (per the U.S. Small Business Administration definition, those with fewer than 500 employees) accounted for 83 percent of the licenses with sales (*see* Table 3). Within the small business category, “medium-sized” companies, with between 100 and 499 employees, accounted for 9 percent of the licenses with sales; “small” companies, with 10 to 99 employees, for 31 percent; and “very small” companies, with fewer than 10 employees, for 42 percent.

However, because of the previously mentioned top-selling drug, the large corporation category accounted for 82 percent of the total sales related to the DoD license agreements. If this product is excluded, the large corporation percentage drops to 41 percent, with small businesses accounting for 59 percent of the total sales.

Large corporations accounted for nearly 58 percent of the **U.S. military sales** resulting from DoD license agreements. This is because large defense contractors are the primary license holders of munitions technologies developed in DoD laboratories. Small companies accounted for the remaining 42 percent of the sales to the U.S. military. Within the small business category, “medium-sized” companies accounted for less than 3 percent of the military sales, “small” companies for not quite 17 percent, and “very small” companies for the remaining 23 percent.



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Table 3. Sales by company size resulting from DoD license agreements, 2000-2014

Company Size	Total Agreements with Sales	Percent of Total Agreements with Sales	Total Sales	U.S. Military Sales
Large (500 or more employees)	61	17	\$16,722,169,461	\$1,985,451,228
Small (<500 employees)	292	83	\$3,720,057,750	\$1,446,896,746
Medium-Size (100-499 employees)	30	9	\$550,409,999	\$86,048,000
Small (10-99 employees)	116	33	\$992,463,276	\$567,280,399
Very Small (1-9 employees)	146	41	\$2,177,184,475	\$793,568,347
Total	353	100	\$20,442,227,211	\$3,432,347,974

Source: Cumulative sales reported by companies to TechLink, Montana State University, during survey from January to September 2015.



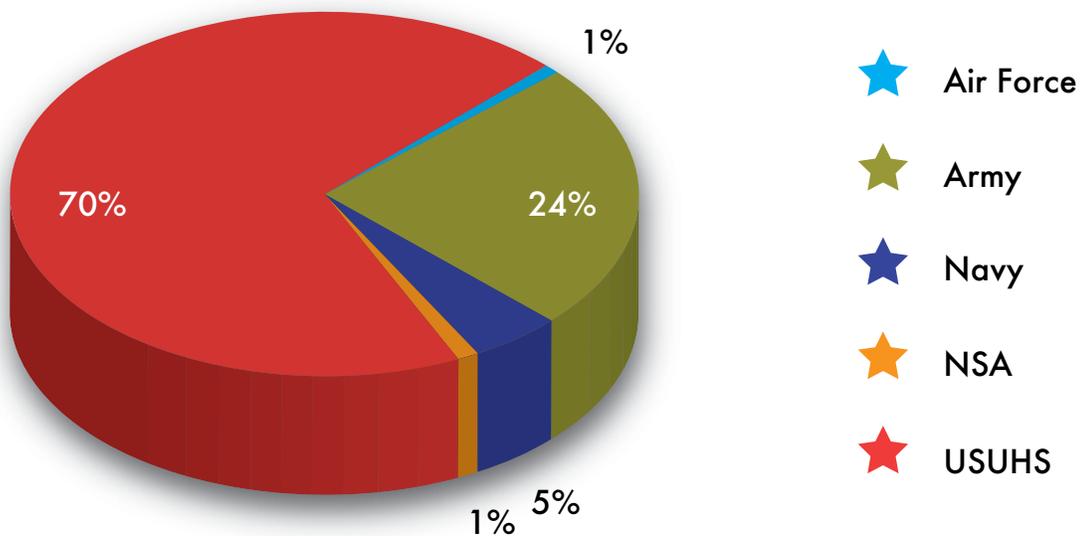
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Sales by Technology Source

Figures 1 and 2 present the sales results by the DoD branch from which the licensed technology originated. The difference between the two charts is that Fig. 1 includes sales of Synagis related to the USUHS license agreement while Fig. 2 does not. Sales of technologies licensed from USUHS were approximately \$14.221 billion, or nearly 70 percent

of the total; from the Army, almost \$4.9 billion, or 24 percent; from the Navy, \$977 million, or 5 percent; from the Air Force, approximately \$257 million, or slightly over 1 percent; and from the National Security Agency (NSA), \$120 million, or less than 1 percent.

Figure 1. Sales Results by DoD Technology Source



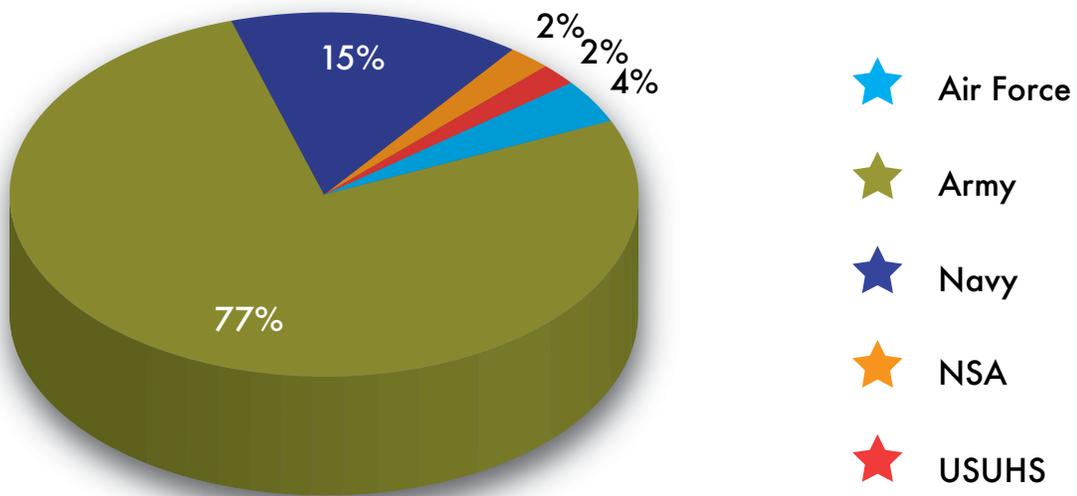


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When Synagis is excluded, the picture changes significantly (see Fig. 2). Sales of technologies licensed from the Army increase to 77 percent of the total; from the Navy, to 15 percent; from the Air

Force, to 4 percent; and from the NSA to nearly 2 percent. The USUHS portion drops from 83 percent to just over 2 percent.

Figure 2. Revised Sales Results by DoD Technology Source (Excluding Synagis)





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Sales by Technology Sector

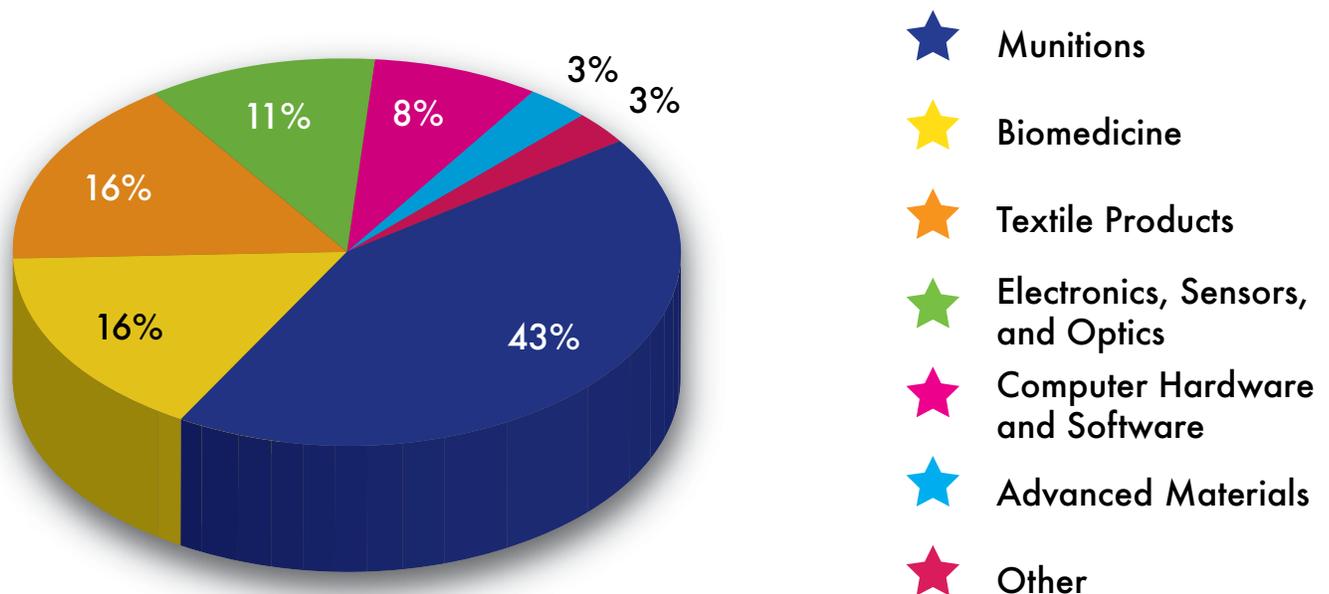
Figure 3 presents the sales results by technology sector. It excludes the top-selling drug, Synagis, which otherwise would have caused the medical sector to dwarf all other sectors. **“Munitions”** comprised the largest sector, with 43 percent of the total sales (excluding Synagis). This sector consisted of various types of armaments and ammunition, including projectile tail cones for tank training rounds, a stabilizer for cannon projectiles, an improved grenade launcher, and weapon sighting devices. It was followed by the **“Textile Products”** and **“Biomedicine”** sectors, both comprising approximately 16 percent of the total sales. Textile products consisted primarily of backpacks and parachutes sold to the U.S. military. The Biomedicine sector encompassed a wide range of technologies that included preventative and therapeutic vaccines and drugs, diagnostic tests, medical devices, wound care products, antibodies used in research, and health-related software.

“Electronics, Sensors, and Optics” was the next

largest sector at 11 percent. This also was a very broad sector and included technologies ranging from communications devices and antennas, to lasers and wearable transmission devices, to avionics diagnostics and sensors for environmental contaminants and biowarfare threats. The **“Computer Hardware and Software”** sector, with 8 percent of the total sales, included circuit designs, cybersecurity hardware and software, image processing algorithms and hardware, and all other software products outside of the medical field, including facilities and project management software programs.

“Advanced Materials” accounted for 3 percent of the total sales and ranged from metal coatings and specialized alloys to bullet-absorbing concrete and nanomaterials. The **“Other”** category, also accounting for 3 percent of the total sales, consisted of all technologies not included in the above sectors, primarily various types of mechanical devices.

Figure 3. Sales by DoD Technology Sector (Excluding Synagis)





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Accuracy of Company Sales Information

Most companies in the study made a sincere effort to provide accurate responses to the questions posed about sales of new products and services related to their license agreements. Their responses ranged from highly detailed spreadsheets of sales figures, broken down by year, to verbal estimates of their cumulative sales, provided over the phone. The research team attempted to verify as much of the sales information as possible. However, this was possible for only a relatively small number of the license agreements. For most agreements, the companies themselves were the only source of information about their sales, including commercial and military sales of new products and services directly related to the licensed DoD technologies, R&D contracts to further develop these technologies, royalties from sublicensing the licensed DoD technologies, sublicensee sales of the licensed technologies, and sales of products or services embodying the licensed technologies by start-up or spin-out companies.

In an attempt to verify as many of the sales as possible, the research team employed Internet

searches of the previously mentioned U.S. government contract and budget web sites and audited company annual reports. In addition, in the case of an Army lab that develops almost exclusively military technology and is closely tied to the procurement process, the research team was able to obtain highly accurate information on U.S. military and foreign military sales by the licensees (all major defense contractors), broken down by each year of the study period.

Using these methods, the research team was able to definitively verify the accuracy of approximately \$17.6 billion of the \$20.4 billion in total sales reported by companies. This represents 86 percent of the total sales. This means that even if the remaining 14 percent of unverified sale figures were off by a third, the reported \$20.4 billion in total sales would be over 95 percent accurate. However, for the reasons summarized in the following section, the total sales figures reported are believed to significantly understate the reality.





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Sales Figures Understate the Reality

For several reasons, total sales figures obtained by this survey understate the reality and are probably significantly smaller than the actual cumulative sales resulting from DoD license agreements during the 2000-2014 period. Reasons include the following:

- *Non-responding companies.* As previously noted, 82 companies with DoD license agreements active during the 2000-2014 period did not participate in the study—50 because they declined to participate and another 32 that could not be contacted because they had ceased to operate as corporate entities. Some companies in the first group are believed to be making sizeable commercial (non-military) sales of products based on the licensed technologies. While the research team was able to capture some of the U.S. military sales of these companies from Internet searches, it was unable to learn of any of their commercial sales.
- *Sub-licensee sales.* The total sales figures also underreport the reality because they do not include most of the sub-licensee sales. The TechLink team asked all companies if they had sublicensed the technologies that they had licensed from DoD. Many companies reported that they had. However, most of these companies declined to identify their sublicensees or to divulge what they knew of sublicensee sales. Some claimed that they were prevented from identifying sublicensees by the terms of their sublicensing agreements. Others simply declined to identify these sublicensees. Sublicensee sales of DoD-licensed technologies

are probably substantial. For example, in 11 cases where licensees did report their sublicensee sales, the combined value was \$443 million.¹¹

- *Licensee underreporting of sales.* Another reason why the total reported sales are believed to be less than the actual sales is that underreporting is common in the licensing world. Historic royalty audit data from the Invotex Group, a well-established accounting and intellectual property management company, reveals that over 80 percent of licensees underreport and underpay royalties to their licensors.¹² There are various reasons why royalties are underreported. However, the Invotex Group found that at least half of the licenses it audited had underreported sales. Frequently, these involved next-generation products based on the licensed technology.
- *Inflation.* Finally, inflation contributes, in effect, to an underreporting of sales. All sales data are expressed in 2014 dollars, as previously discussed. However, some of the company sales date back to the early 2000s and most occurred prior to 2014. Use of 2014 as the reference year does not consider the higher value of the earlier sales figures. For example, a dollar in 2000 was worth 37 percent more than a dollar in 2014.

For all of the above reasons, the total sales figures reported in this survey are conservative and probably significantly understate the actual total sales resulting from DoD license agreements during the 2000-2014 period.

¹¹ "Sublicensee sales" includes both direct product sales and R&D contracts related to the sublicensed technologies.

¹² D.R. Stewart and J.A. Byrd, "The Significance of Underreported Royalties-2007 Update: The Magnitude and Meaning of Royalty Misreporting," Invotex Group, Baltimore, MD, February 2007, online at: www.lawseminars.com/materials/07LICIL/licil%20m%20stewart2.pdf; D.R. Stewart and J.A. Byrd, "89% of Royalty Revenue is Underreported! Top Five Questions You Should Ask Your Licensee to Avoid Becoming a Statistic," Invotex Group, Baltimore, MD, April 2012, online at: <http://nebula.wsimg.com/025008bfa2f13f473388c5848f4dd0c8?AccessKeyId=2ACC09671B2FE74DD41F&disposition=0&alloworigin=1>



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

OTHER ECONOMIC OUTCOMES

In addition to sales, the companies in the study reported other significant economic outcomes. They reported approximately \$609 million in total outside investment funding (including venture capital and angel funding) directly related to the licensed DoD technologies. In addition, 22 companies were acquired primarily because of their DoD license agreements, with a total acquisition value reported to be around \$438 million. However, this figure certainly understates the actual value. A large majority of acquired companies stated that the terms of acquisition prevented them from disclosing the acquisition amount. Finally, companies in the study reported that they had sublicensed 48 technologies to other companies, and that they had created a total of 28 spin-out companies specifically to commercialize 29 of the licensed DoD technologies.

These other economic outcomes are summarized below:

- **Total outside investment funding:** \$609,285,000
- **Number of companies that were acquired:** 22
- **Total acquisition value of companies acquired:** \$438,000,000
- **Number of DoD technologies sublicensed to other companies:** 48
- **Number of spin-out companies created:** 28
- **Number of technologies being commercialized by spin-outs:** 29





National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

ECONOMIC IMPACT ANALYSIS

Upon receiving the company sales and NAICS code data from TechLink, the Business Research Division at the University of Colorado Boulder employed IMPLAN to determine the economic contribution effects of the total sales figures. Results below are presented for output, value added, employment, labor income, and tax revenues. As previously noted, all dollar figures are reported in 2014 dollars.

OUTPUT

Output is the total value of purchases by intermediate and final consumers. According to the national IMPLAN model, the \$20.4 billion (2014 \$) in direct sales of new products and services reported by companies generated an additional \$28.3 billion in sales economy-wide. Of this amount, approximately \$15.2 billion was generated indirectly as the result of inter-industry purchases (firms purchasing from each other), and \$13.1 billion was generated from the induced effect, the result of households spending payroll on goods and services economy-wide (*see* Table 4, p. 26). The total economy-wide output (the sum of direct, indirect, and induced sales) was \$48.8 billion.

Dividing total economy-wide output (\$48.8 billion) by the direct output of companies selling products and services related to their license agreements with DoD yielded an output multiplier of approximately 2.4. That is, for every dollar in sales directly attributable to the DoD license agreements, an additional \$1.39 in sales was generated economy-wide.

VALUE ADDED

Value added is the difference between the value of an industry's or company's output and the cost of intermediate inputs. Expressed differently, it is the difference between a product's sale price and its production cost. This measure recognizes that companies buy goods and services from other companies in order to create products of greater value than the sum of the goods and services used to make these products. This increase in value resulting from the production process is the "value added." As estimated by IMPLAN, value added is equal to the total sales (plus or minus inventory adjustments) minus the cost of the goods and services purchased to produce the products sold.

The main difference between output and value added is that output includes the value of intermediate goods and services, while value added does not. Many economists prefer value added as an economic measure because, at the macroeconomic scale, output multiple-counts the value of inputs. For example, in the previously cited case of Company X, which sells an improved barcode scanner based on an Air Force laser invention: Company X purchases laser rods, electronic components, optical components, and various raw materials to make the barcode scanner. The value of Company X's sales incorporates the value of these laser rods and other inputs. Further, each of the companies from which Company X purchases its inputs incorporates the value of their respective inputs from other companies. By combining and aggregating the values of intermediate and final products, output overstates



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the size of the U.S. economy by a factor of roughly 2. For this reason, Gross Domestic Product (GDP), a measure of value added, is used to track the size of the U.S. economy because it is a non-duplicative aggregation of production across all industries in the United States.

In the current study, value added measures the real contribution that each of the DoD technology transfer partners made to the national economy as a result of their license agreements with DoD. According to the national IMPLAN model, the \$20.4 billion (2014 \$) in sales reported by companies generated \$23.9 billion in value added impact economy-wide. Of this total, \$9.2 billion was generated directly, \$7.6 billion was generated indirectly, and \$7.1 billion was generated from the induced effect (*see* Table 4, p. 26).

EMPLOYMENT

According to the national IMPLAN model, an estimated 41,753 jobs were directly sustained economy-wide by the \$20.4 billion in sales. Indirect effects were responsible for an additional 61,185 jobs, and induced effects for 80,047 jobs. The IMPLAN model estimates that, altogether, 182,985 jobs nationwide resulted from the direct, indirect, and induced effects of the DoD license agreements with U.S. industry during the 2000-2014 period. This means that, on average, the DoD license agreements generated approximately 12,199 jobs per year.

Using the procedure outlined above to derive the multiplier, an employment multiplier of 4.39 was calculated. That is, for every job directly attributable to the DoD license agreements, 3.39 additional job years were created or retained economy-wide. This substantial multiplier was mainly due to the relatively high-paying jobs associated with high-tech and technology-based

industries, which accounted for the majority of the companies involved. That is, workers in these well-paying industries pumped more income back into the economy than lower-paid workers in other sectors, resulting in more job creation economy-wide.

LABOR INCOME

Labor income consists of employee compensation (wage and salary payments, including benefits), paid to workers as well as proprietary income (income received by self-employed individuals). The national IMPLAN model estimated that labor income directly associated with the \$20.4 billion in sales was \$4.3 billion in 2014, or approximately \$104,058 per job. This was more than double the average U.S. wage in 2014 of \$46,482.¹³

The indirect labor income was estimated at \$4.6 billion, or approximately \$75,890 per job. The induced labor income was estimated to be \$4.1 billion, or \$50,789 per job. Average wages for the indirect and induced jobs were substantially lower than the average wage for the jobs directly created or retained because many of these additional jobs were in lower-paid manufacturing and service sectors. Together, the indirect and induced labor income amounted to \$8.7 billion. The total economy-wide labor income resulting in 2014 from the DoD license agreements was \$13.1 billion. The average wage of the approximately 182,985 jobs created or retained as a result of the DoD license agreements was \$71,337, approximately 53 percent higher than the average U.S. wage of \$46,482 in 2014.

The labor income multiplier was approximately 3.1, indicating that for every dollar in wage and salary income attributable to the DoD license agreements, an additional \$2.10 was generated nationally in employee compensation and proprietary income.

¹³ Per the Social Security Administration, <https://www.ssa.gov/oact/cola/AWI.html>



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

TAX REVENUES

Tax revenues were estimated for the \$20.4 billion in sales and their economy-wide indirect and induced effects. These tax revenues included social insurance taxes such as Social Security and Medicare (paid by employers, employees, and the self-employed), personal income taxes, motor vehicle licenses, property taxes, corporate profits taxes and dividends, and indirect business taxes (comprised mainly of excise and property taxes,

fees, licenses, and sales taxes). Total taxes collected by federal, state, and local government entities were estimated at \$1.6 billion. This included slightly over \$1.2 billion in federal tax revenues and \$400 million in state and local tax revenues. In sum, for every dollar of sales related to the DoD license agreements, an additional \$0.08 was generated in federal, state, and local tax revenue.





National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

SUMMARY

In summary, this study estimated the economic contribution to the U.S. economy of Department of Defense (DoD) license agreements in effect during the 2000-2014 period. Its purpose was to determine the extent to which these license agreements (1) contributed to new economic activity and job creation in the United States, and (2) resulted in the transition of new technology to U.S. military use.

The study surveyed 602 companies having license agreements with DoD during the 2000-2014 period. A total of 733 license agreements were involved because some companies had multiple agreements. Companies were asked to divulge the total sales of new products and services directly related to their DoD license agreements. They were also asked about their license-related sales to the U.S. military, either directly or through a defense contractor. Nearly half of the companies—353 out of 733—reported sales. Collectively, they reported slightly over \$20.4 billion in total sales and \$3.4 billion in military sales (in 2014 dollars).

IMPLAN economic impact assessment software was used to estimate the total economic impacts related to these sales. Impacts analyzed included economic output, value added, employment, labor income, and tax revenues. Total economy-wide sales, as measured by output, were estimated at \$48.8 billion. Value added was estimated at \$23.9 billion, representing new wealth creation in the economy. Employment impacts included 182,985 jobs with an average wage of \$71,337. Labor income in 2014 was estimated at \$13.1 billion. The \$20.4 billion in sales and its economy-wide effects generated approximately \$1.6 billion in federal, state, and local tax revenues. Table 4 summarizes the total economic contribution of the DoD license agreements with U.S. industry.

\$20.4 B

**Total sales
new products & services**

\$48.8 B

Total economic output

182,985

Full-time jobs created

\$71,337

**Average salary of
jobs created**



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 4. Nationwide Economic Impacts from DoD License Agreements, 2000-2014

Impact Type	Output \$ Billions	Value Added \$ Billions	Employment (Number of jobs created or retained)	Labor Income \$ Billions	Average Wage (US = \$46,482)	Tax Revenue \$ Billions
Direct Impact	\$20.4	\$9.2	41,753	\$4.3	\$104,058	
Indirect Impact	\$15.2	\$7.6	61,185	\$4.6	\$75,890	
Induced Impact	\$13.1	\$7.1	80,047	\$4.1	\$50,789	
Federal Tax Revenues						\$1.2
State and Local Tax Revenues						\$0.4
Total Economy-Wide Impact	\$48.8	\$23.9	182,985	\$13.1	\$71,337	\$1.6

Source: BRD, University of Colorado Boulder; IMPLAN. Note: Totals may not tally due to rounding.



APPENDIX 1

NATIONAL ECONOMIC IMPACTS BY DoD COMPONENTS

The following appended tables provide a more focused look at the economic impacts from DoD license agreements during the 2000-2014 period. These tables break out the economic impacts by selected DoD components from which the licensed technologies originated. These include the three DoD services—Army, Navy, and Air Force—as well as the National Security Agency, the Uniformed Services University of the Health Sciences, and selected DoD commands and laboratories that had at least four license agreements achieving sales and total sales exceeding \$10 million. Breakouts for other DoD labs are not included for two reasons. First, revealing the outcomes of the limited number of license agreements from these labs could enable fairly accurate guesses about the sales of specific companies, violating the need to keep company sales information confidential. Second, the total sales related to their license agreements were usually too small and geographically concentrated to be legitimately analyzed by the national IMPLAN model. For explanation of the economic terms used in the appendices, please refer to the main text of the report.

Tables

1. Air Force
2. Air Force Research Laboratory (AFRL)
3. AFRL Aerospace Systems Directorate
4. AFRL Information Directorate
5. AFRL Materials & Manufacturing Directorate
6. AFRL Space Vehicles Directorate, Kirtland AFB
7. AFRL 711th Human Performance Wing
8. Army
9. Army Research, Development and Engineering Command (RDECOM)
10. Army Armament Research, Development and Engineering Center (ARDEC)
11. Army Edgewood Chemical Biological Center
12. Army Natick Soldier Research, Development and Engineering Center
13. Army Research Laboratory (ARL)
14. Army Corps of Engineers
15. Army Corps of Engineers, Construction Engineering Research Laboratory
16. Army Corps of Engineers, Geotechnical and Structures Laboratory
17. Army Medical Research and Materiel Command (USAMRMC)
18. Army Medical Materiel Development Activity (USAMMDA)
19. Army Medical Research Institute of Infectious Diseases (USAMRIID)
20. Walter Reed Army Institute of Research (WRAIR)
21. National Security Agency (NSA)
22. Navy
23. Naval Air Systems Command
24. Naval Air Warfare Center, Aircraft Division (NAWCAD)



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Tables (cont.)

25. Naval Facilities Engineering and Expeditionary Warfare Center
26. Naval Medical Research Center (NMRC)
27. Naval Research Laboratory (NRL)
28. Naval Sea Systems Command
29. Naval Surface Warfare Center, Carderock Division
30. Naval Surface Warfare Center, Crane Division
31. Naval Undersea Warfare Center, Division Newport
32. Space and Naval Warfare Systems Center Pacific
33. Uniformed Services University of the Health Sciences (USUHS)





National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 1. Air Force

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$257	\$115	1,033	\$85	\$81,886
Indirect Impact	\$212	\$104	1,033	\$68	\$65,814
Induced Impact	\$222	\$121	1,358	\$69	\$50,784
Total Economy-Wide Impact	\$691	\$340	3,425	\$222	\$64,702

Table 2. Air Force Research Laboratory (AFRL)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$225	\$100	938	\$75	\$79,759
Indirect Impact	\$185	\$91	915	\$60	\$65,196
Induced Impact	\$196	\$107	1,196	\$61	\$50,786
Total Economy-Wide Impact	\$606	\$298	3,049	\$195	\$64,021



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 3. AFRL Aerospace Systems Directorate

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$114	\$55	631	\$43	\$68,257
Indirect Impact	\$102	\$49	540	\$33	\$61,468
Induced Impact	\$111	\$60	678	\$34	\$50,780
Total Economy- Wide Impact	\$327	\$165	1,849	\$111	\$59,868

Table 4. AFRL Information Directorate

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$18	\$9	69	\$7	\$104,395
Indirect Impact	\$11	\$6	60	\$4	\$65,229
Induced Impact	\$16	\$9	99	\$5	\$50,769
Total Economy- Wide Impact	\$45	\$24	227	\$16	\$70,760



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 5. AFRL Materials & Manufacturing Directorate

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$12	\$6	38	\$4	\$96,294
Indirect Impact	\$10	\$5	49	\$3	\$65,462
Induced Impact	\$10	\$5	62	\$3	\$50,821
Total Economy- Wide Impact	\$32	\$16	148	\$10	\$67,331

Table 6. AFRL Space Vehicles Directorate, Kirtland AFB

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$11	\$6	48	\$5	\$98,761
Indirect Impact	\$8	\$5	50	\$3	\$62,649
Induced Impact	\$11	\$6	69	\$4	\$50,775
Total Economy- Wide Impact	\$31	\$17	167	\$11	\$68,002



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 7. AFRL 711th Human Performance Wing

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$65	\$23	141	\$15	\$105,825
Indirect Impact	\$51	\$24	201	\$15	\$75,439
Induced Impact	\$44	\$24	268	\$14	\$50,803
Total Economy- Wide Impact	\$160	\$71	610	\$44	\$71,623

Table 8. Army

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$4,866	\$2,119	18,005	\$1,266	\$70,320
Indirect Impact	\$4,457	\$1,988	17,415	\$1,231	\$70,716
Induced Impact	\$3,643	\$1,985	22,268	\$1,131	\$50,790
Total Economy- Wide Impact	\$12,966	\$6,092	57,687	\$3,629	\$62,901



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 9. Army Research, Development and Engineering Command (RDECOM)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$3,966	\$1,698	14,804	\$976	\$65,900
Indirect Impact	\$3,747	\$1,621	14,140	\$1,002	\$70,856
Induced Impact	\$2,886	\$1,572	17,637	\$896	\$50,790
Total Economy- Wide Impact	\$10,598	\$4,891	46,581	\$2,873	\$61,683

Table 10. Army Armament Research, Development and Engineering Center (ARDEC)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$2,487	\$1,103	6,266	\$483	\$77,157
Indirect Impact	\$2,281	\$1,007	8,712	\$620	\$71,132
Induced Impact	\$1,612	\$878	9,851	\$500	\$50,792
Total Economy- Wide Impact	\$6,379	\$2,988	24,829	\$1,604	\$64,582



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 11. Army Edgewood Chemical Biological Center

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$33	\$17	115	\$12	\$104,821
Indirect Impact	\$25	\$13	121	\$8	\$64,365
Induced Impact	\$29	\$16	177	\$9	\$50,778
Total Economy- Wide Impact	\$86	\$45	414	\$29	\$69,832

Table 12. Army Natick Soldier Research, Development and Engineering Center

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$971	\$377	6,632	\$322	\$48,538
Indirect Impact	\$1,012	\$403	3,621	\$250	\$69,005
Induced Impact	\$832	\$454	5,089	\$258	\$50,786
Total Economy- Wide Impact	\$2,816	\$1,234	15,342	\$830	\$54,114



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 13. Army Research Laboratory (ARL)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$323	\$130	1,264	\$108	\$85,365
Indirect Impact	\$291	\$134	1,157	\$84	\$72,225
Induced Impact	\$279	\$152	1,708	\$87	\$50,794
Total Economy- Wide Impact	\$894	\$417	4,129	\$278	\$67,384

Table 14. Army Corps of Engineers

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$193	\$81	949	\$63	\$66,722
Indirect Impact	\$182	\$87	834	\$55	\$65,610
Induced Impact	\$172	\$94	1,052	\$53	\$50,785
Total Economy- Wide Impact	\$547	\$262	2,836	\$172	\$60,482



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 15. Army Corps of Engineers, Construction Engineering Research Laboratory

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$47	\$28	230	\$25	\$107,110
Indirect Impact	\$29	\$17	178	\$11	\$61,826
Induced Impact	\$52	\$28	318	\$16	\$50,791
Total Economy- Wide Impact	\$128	\$74	726	\$52	\$71,358

Table 16. Army Corps of Engineers, Geotechnical and Structures Laboratory

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$129	\$47	645	\$34	\$52,923
Indirect Impact	\$133	\$62	591	\$39	\$66,136
Induced Impact	\$107	\$58	653	\$33	\$50,787
Total Economy- Wide Impact	\$369	\$167	1,890	\$106	\$56,319



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 17. Army Medical and Materiel Command (USAMRMC)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$730	\$346	2,102	\$221	\$104,992
Indirect Impact	\$551	\$293	2,514	\$183	\$72,995
Induced Impact	\$589	\$321	3,598	\$183	\$50,789
Total Economy- Wide Impact	\$1,870	\$960	8,213	\$587	\$71,458

Table 18. Army Medical Materiel Development Activity (USAMMDA)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$75	\$33	335	\$16	\$47,714
Indirect Impact	\$65	\$34	279	\$22	\$78,132
Induced Impact	\$55	\$30	337	\$17	\$50,784
Total Economy- Wide Impact	\$195	\$96	951	\$55	\$57,732



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 19. Army Medical Research Institute of Infectious Diseases (USAMRIID)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$500	\$240	1,096	\$149	\$135,651
Indirect Impact	\$361	\$192	1,583	\$119	\$75,354
Induced Impact	\$390	\$213	2,386	\$121	\$50,789
Total Economy- Wide Impact	\$1,252	\$644	5,065	\$389	\$76,835

Table 20. Walter Reed Army Institute of Research (WRAIR)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$128	\$61	575	\$47	\$81,157
Indirect Impact	\$104	\$55	534	\$35	\$64,977
Induced Impact	\$118	\$65	724	\$37	\$50,790
Total Economy- Wide Impact	\$350	\$180	1,833	\$118	\$64,450



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 21. National Security Agency

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$120	\$46	231	\$28	\$120,754
Indirect Impact	\$130	\$61	514	\$38	\$73,683
Induced Impact	\$96	\$52	586	\$30	\$50,787
Total Economy- Wide Impact	\$346	\$160	1,330	\$95	\$71,769

Table 22. Navy

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$977.3	\$431.2	3,425	\$345.9	\$101,004
Indirect Impact	\$811.4	\$421.3	4,113	\$269.5	\$65,511
Induced Impact	\$896.4	\$488.4	5,479	\$278.3	\$50,788
Total Economy- Wide Impact	\$2,685.0	\$1,340.9	13,018	\$893.7	\$68,653



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 23. Naval Air Systems Command

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$171	\$72	432	\$52	\$119,220
Indirect Impact	\$155	\$75	670	\$47	\$70,433
Induced Impact	\$144	\$78	879	\$45	\$50,787
Total Economy- Wide Impact	\$470	\$225	1,981	\$143	\$72,362

Table 24. Naval Air Warfare Center, Aircraft Division (NAWCAD)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$130	\$50	278	\$36	\$127,858
Indirect Impact	\$125	\$57	486	\$35	\$73,100
Induced Impact	\$104	\$56	633	\$32	\$50,795
Total Economy- Wide Impact	\$358	\$163	1,397	\$103	\$73,902



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 25. Naval Facilities Engineering and Expeditionary Warfare Center

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$69	\$37	420	\$38	\$89,304
Indirect Impact	\$48	\$27	310	\$19	\$60,877
Induced Impact	\$82	\$45	502	\$25	\$50,780
Total Economy- Wide Impact	\$200	\$109	1,232	\$82	\$66,463

Table 26. Naval Medical Research Center (NMRC)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$44	\$23	160	\$17	\$103,840
Indirect Impact	\$32	\$19	194	\$12	\$63,243
Induced Impact	\$42	\$23	257	\$13	\$50,786
Total Economy- Wide Impact	\$119	\$65	611	\$42	\$68,630



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 27. Naval Research Laboratory (NRL)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$479	\$217	1,733	\$175	\$100,843
Indirect Impact	\$381	\$196	1,885	\$126	\$66,855
Induced Impact	\$438	\$239	2,678	\$136	\$50,789
Total Economy- Wide Impact	\$1,297	\$652	6,296	\$437	\$69,378

Table 28. Naval Sea Systems Command

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$175	\$65	557	\$53	\$95,158
Indirect Impact	\$162	\$88	906	\$55	\$60,276
Induced Impact	\$157	\$85	958	\$49	\$50,787
Total Economy- Wide Impact	\$493	\$238	2,420	\$156	\$64,549



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 29. Naval Surface Warfare Center, Carderock Division

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$16	\$7	60	\$5	\$76,712
Indirect Impact	\$12	\$6	57	\$4	\$64,678
Induced Impact	\$12	\$7	74	\$4	\$50,821
Total Economy- Wide Impact	\$40	\$19	191	\$12	\$63,115

Table 30. Naval Surface Warfare Center, Crane Division

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$13	\$6	36	\$3	\$78,960
Indirect Impact	\$12	\$5	47	\$3	\$69,870
Induced Impact	\$9	\$5	55	\$3	\$50,797
Total Economy- Wide Impact	\$34	\$16	138	\$9	\$64,696



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

Table 31. Naval Undersea Warfare Center, Division Newport

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$137	\$50	427	\$43	\$100,345
Indirect Impact	\$129	\$72	761	\$45	\$58,917
Induced Impact	\$128	\$70	780	\$40	\$50,790
Total Economy- Wide Impact	\$393	\$191	1,968	\$127	\$64,678

Table 32. Space and Naval Warfare Systems Center Pacific

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$33	\$14	98	\$10	\$101,655
Indirect Impact	\$28	\$14	120	\$9	\$72,734
Induced Impact	\$27	\$15	166	\$8	\$50,801
Total Economy- Wide Impact	\$88	\$43	384	\$27	\$70,588



National Economic Impacts from DoD License Agreements With U.S. Industry, 2000-2014

License Agreements, 2000-2014

Table 33. Uniformed Services University of the Health Sciences (USUHS)

Impact Type	Output \$ Millions	Value Added \$ Millions	Employment (Number of jobs created or retained)	Labor Income \$ Millions	Average Wage (US = \$46,482)
Direct Impact	\$14,221	\$6,485	19,065	\$2,621	\$137,465
Indirect Impact	\$9,608	\$5,036	38,114	\$3,037	\$79,672
Induced Impact	\$8,240	\$4,489	50,363	\$2,558	\$50,789
Total Economy- Wide Impact	\$32,069	\$16,011	107,542	\$8,215	\$76,392

Source of the information in the tables is: TechLink survey of licensees, January to September 2015; BRD, University of Colorado Boulder; IMPLAN.

Note: "Employment" is measured in job-years. Totals may not tally due to rounding.



APPENDIX 2

COMPARISON OF RESULTS: 2015 vs. 2012 DoD LICENSING ECONOMIC IMPACT STUDIES

The current study is an update of a similar study undertaken in 2012. That study focused on the economic impacts from DoD license agreements during the 2000-2011 period. This study extends the timeframe by three years, covering the period through 2014. The methodology used in these two studies was essentially the same. Differences in the total and U.S. military sales are primarily a function of the longer time period for the latest study. An additional 131 license agreements were established during the intervening three years—a 22 percent increase in the number of active agreements. More important, previously established agreements had three additional years in which to come to fruition or further accumulate sales. The differences in the value added, total economic output, and employment reflect these changes in sales and also are a function of the differences in the IMPLAN models used (2011 vs. 2014).

\$13.4B → **\$20.4B** = **52%**
in sales **in sales** **increase**
2012 **2015**

Table 1. Comparison of 2012 and 2015 DoD Licensing Economic Impact Study Results

	2012 Economic Impact Study	2015 Economic Impact Study	Percentage Increase
Total Sales, New products and services	\$13.4 Billion	\$20.4 Billion	52
Sales to U.S. Military	\$1.3 Billion	\$3.4 Billion	162
Value Added	\$17.4 Billion	\$23.9 Billion	37
Total Economic Output nationwide	\$36.3 Billion	\$48.8 Billion	34
Full-Time Jobs created or retained	163,067	182,985	12