

Department of Defense Service Contract Spending Explorer - PPOL563 Final Project

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[Link to Visualization](#)

[Link to Github Repository](#)

Executive Summary

This interactive web app allows users to explore the Department of Defense's spending on service contracts over time. Visualizing trends in this spending can demonstrate opportunities to implement category management, a best procurement practice encouraged by GAO, GSA, and OMB to consolidate contracts within core spending categories across an enterprise. By interacting with plots of DoD's contract spending broken down across various categories and classifications, users can further their understanding not only of how DoD compares to other agencies, but what areas offer the most potential to implement category management efforts.

The Case for Category Management

The Department of Defense (DoD) spends more on service contracts than any other agency. [In FY22, DoD accounted for 46% of the federal government's spending on prime awards for service contracts at \\$169.6 billion](#); the Department of Energy is a very distant second at \$37.7 billion. As such, a great deal of scrutiny has been applied on the part of regulatory agencies to DoD service contracts. [Since 1992, DoD contracting has been on the General Accountability Office's \(GAO\) "High-Risk List,"](#) having been identified as an operation that is highly vulnerable to fraud, waste, abuse, and mismanagement. In February 2021, [GAO reported](#) that the agency's service requirements reviews were still "narrowly focused on individual contracts rather than entire capability portfolios."

A [2013 GAO report](#) suggested that federal agencies should follow the lead of the private sector when it comes to service acquisition, and that implementing leading industry practices for strategic sourcing could result in cost savings of up to 4% for the federal government at large. Several initiatives have been recommended to promote cost savings in this area, including a strategy common to the private sector known as category management.

Championed by the General Services Administration (GSA), [category management](#) is a strategy that helps organizations make smarter purchases of goods and services by identifying core spending categories and making those acquisitions as a combined enterprise, allowing for the consolidation and reduction of contracts. In doing so, organizations can also reduce the amount of time and resources spent on procuring services (such as reviewing bids and vetting contractors) and managing ongoing contracts.

Category management still has not been embraced widely as a best practice. The purpose of this series of interactive visualizations is to allow the users to further their understanding of

concepts in federal contracting and explore trends in DoD service contract spending that could demonstrate the potential for category management. Visualizing contract data can illuminate not only the magnitude of DoD's contractual service spending in comparison to other federal agencies, but the extent to which DoD awards a large number of contracts, sometimes with relatively low dollar values, for similar services in the same geographic areas throughout the fiscal year.

Data and Sources

USAspending was the source for all data used. I used the [Advanced Search portal](#) to download contract data for each fiscal year, using the available filters to limit the search to DoD prime award contracts for services. I also used the [USAspending API](#) to retrieve total spending data for multiple agencies, which is featured in the second line chart on the "Comparing Other Agencies" tab of the app. USAspending compiles its award data from multiple sources, including:

- The Federal Procurement Data System (FPDS), where federal contracting officials must submit transaction-level data
- The System for Award Management (SAM.gov), where potential recipients must register to be eligible to receive federal prime awards
- The Federal Funding Accountability and Transparency Act Subaward Reporting System (FSRS), where prime recipients submit information about their subawards

DoD contract data is published on a 90-day delay in the Federal Procurement Data System (FPDS), so that delay is also reflected in data downloaded from USAspending. However, because I am only using data through the end of FY2022 (September 30, 2022), the effect of delays should be minimal, if any.

When considering biases and sampling, it is likely that there are some contract information that is unreported or incorrectly due to human error of employees who are responsible for reporting.

USAspending data is available to the public, including researchers, journalists, small business owners, public servants, government watchdogs, to use without a license. On their site, they outline possible and recommended use cases for their data such as:

- Federal Spending Transparency and Accountability
- Market Research
- Grant Opportunities and Compliance
- Federal Spending Trends and Stories (like this one)

Because the data are not associated with any PII or any information related to individual persons, I do not foresee any privacy issues with this data. Each record in the raw data provides a high level summary of the contract in question; the specific details of the contract, such as information on the employees who will service the contract, are not known. All service locations

are approximate and are for the most part the location of known military installations and facilities.

In total, I downloaded 5.4 GB of contract data that represented hundreds of thousands of contracts and multiple trillion dollars of obligations. To reduce dimensionality, I focused on several key features and wrote a function to group the data for each fiscal year by:

- Awarding Subagency
- Awarding Office
- Contract Recipient
- Primary Place of Performance (State)
- NAICS code
- Product or Service Code (PSC)
- Contract Bundling Status

I stored only the summarized data in the Github repository for the project, to avoid overly large files.

For the coordinate map on the “Mapping Contracts Awarded” tab, I used the package *Nominatim* to assign latitude and longitude coordinates to each address for a contract’s service provider and primary service location. Because this process takes a long time, I only did this for a smaller subset of contracts that fell into the category of Facility Related Services. Since Nominatim uses the OpenStreetMap API, I attempted to implement an asynchronous process using *asyncio* to optimize the operation to retrieve the coordinates. However, because I was at the time trying to retrieve coordinates for over 19,000 addresses, I kept experiencing issues with rate limiting that I was not able to resolve.

I ended up writing a normal, synchronous function called `lat_long` to retrieve coordinates and set it to run overnight, storing the coordinates in a CSV file along with their contract IDs so that I would not have to run the function again. I found 22 unique addresses that did not return coordinates, so I manually searched for them on Google Maps, which allowed me to correct some typos that were present in the raw dataset and fill in some of the missing coordinates.

Technologies Used

To prepare the data for visualization, I did most of my data cleaning in a Jupyter Notebook, which can be found in the Github repository for the project. The geocoding function and the API data retrieval function can each be found in separate .py files. I did successfully implement [*asyncio*](#) to asynchronously executive requests to the USAspending API and increase efficiency of data retrieval, because each year of data for each agency must be retrieved using an individual request.

I used *Streamlit* to build the web app. All plots were created using *plotly* with the exception of the choropleth plot on the “Mapping Contracts Awarded” tab, which was created with

geopandas, and the coordinate plot, which uses *streamlit*'s native integration with OpenStreetmap through their [st.map](#) feature.

The app is published on Streamlit Cloud through its integration with Github, where the project repository is stored. As a requirement for successfully publishing an app on Streamlit Cloud, the Pipfile stored in the "myenv" folder of the repository with the app script contains the specifications for packages needed to run the app. Though font sizes were appropriately set in the code, Streamlit Cloud appears to uniformly impose smaller font sizes for plot titles, data labels, and axis labels, despite any efforts to the contrary. I was not able to resolve this and regret any impact on readability.

Summary of Analysis and Key Insights

The application is divided into five tabs:

1. Understanding the Context

This section outlines the contextual information on DoD service contracting and category management, which is described in the introduction of this report.

2. Comparing Other Agencies

This section features two line graphs. The user has the opportunity to select another federal agency from a list of the other top ten federal agencies who lead in service contracting. The first plot compares the selected agency's to DoD's service contract spending, and the second plot compares the selected agency to DoD's total spending. The plots show that DoD's trends in both service contract spending and total spending mirror one another. This is not necessarily the case for all federal agencies; for instance, the Department of Health and Human Services has a much larger budget than the DoD, mostly owing to operations in the Center for Medicare and Medicaid Services, but spend a fraction of what DoD spends on service contracts.

3. Breaking Down Service Contracts

This section shows a stacked bar chart that can be modified to reflect the total dollar value of total number of contracts awarded. This tab and the remaining tabs reflect data on all contracts awarded by DoD, some of which have not actually been obligated (money spent.) The data can be broken down in the stacked bar chart by awarding subagency, awarding office, or contract recipient. Large branches like the Army and Navy do award more contracts and more funding, but some smaller offices and divisions do emerge as big spenders. Unsurprisingly, well-known vendors like Lockheed Martin, The Boeing Company, and Humana (a healthcare company) emerge as leaders in contracts and funding received.

Though the dollar value of contracts awarded peaked in FY2019, the number of contracts awarded has been decreasing steadily since FY2012. The proportion of funding awarded by

larger subagencies and offices remains relatively consistent, indicating that DoD has been awarding more higher-value contracts and fewer low-value contracts. This shows that DoD has been bundling contracts to a greater degree over time, but this is not necessarily evidence of category management efforts.

4. Categorizing Contracts

This section features a pie chart that can be modified to break down contract funding awarded by NAICS code, Product or Service Code, and Contract Bundling Status. The user can select a fiscal year to display data. The section also includes some background information on each of these categorizations for the user's awareness, and links to helpful resources with more details. The bulk of service contracts are awards for Engineering and Technical Services, which includes services like information technology management and telecommunications. For these services, DoD seems to prefer to hire contractors over FTEs. This could be attributed to challenges with recruitment and retention of highly skilled individuals to accomplish specific technical projects.

Based on Federal Acquisition Regulations (FAR), most DoD contracts do not require bundling. FAR places restrictions on bundling to promote competition and preserve award opportunities for small businesses.

5. Mapping Contracts Awarded

This section features a choropleth map map that shows the sum of contract funds awarded in each state; the user can also select a fiscal year for this visualization. The bulk of funding for service contracts is awarded in a handful of states like California, Texas, and Virginia, where there are a large number of military installations and facilities. This does not appear to change very much over the 10 year period of data featured. Virginia repeatedly stands out as being the primary place of performance for the largest total dollar value of contracts awarded. This is likely attributed to very lucrative contracts being awarded to service IT cloud data centers in Virginia, the maintenance of very old and historically important real property assets (buildings) in the state, and several shipyards and docks that need frequent servicing.

This section also features a coordinate plot that is limited to contracts awarded in FY2022 for Facility Related Services. Common, recurring, installation-level services, like those that fall into this PSC category, are especially suited to the implementation of category management practices because the places of performance for these services are usually clustered near one another. The dropdown that accompanies this plot allows the user to select a specific PSC description to see the service locations associated with those contracts. In my opinion, this is most compelling evidence in favor of category management; contracts like these should be consolidated in order to achieve economies of scale in procuring similar service with locations that are physically near one another.