Audit and Financial Management Analytics in DoD are a 'Big Data' Problem

June 02, 2017
Agenda

• OUSD(C) Business Integration Office (BIO) – Greg Little
  – BIO’s mission
  – DoD’s FM vision
  – Data as a strategic asset

• DoD CIO Initiative in Big Data – Joe Horab
  – Big Data and data analytics
  – Data architecture and process
  – Examples of Big Data use

• OUSD (C) Use Cases – Greg Little

• Conclusion
OUSD(C) Business Integration Office (BIO)

Greg Little
BIO’s Mission Statement

DoD Financial Management community lead for creating and sustaining modern, effective, and cost conscience financial management processes, data, systems, policies, and work-force.

$5.2 Billion
Cost of FM Line of Business

250+
FM IT Systems

2,000+
Point to Point Interfaces
### BIO’s Alignment to DoD FM Vision & Goals

#### DoD’s FM Vision

To achieve a DoD FM environment that is standard, simplified, affordable, auditable, and secure.

<table>
<thead>
<tr>
<th>GOAL</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Achieve audit readiness and sustain an auditable business environment</td>
</tr>
<tr>
<td>2</td>
<td>Enhance and implement financial policies and processes to improve, standardize, and simplify the FM business and systems environment</td>
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<td>3</td>
<td>Develop and maintain a well-trained financial workforce that has the knowledge, skills, and abilities to provide decision support and analysis as well as achieve and sustain an auditable business environment</td>
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<td>4</td>
<td>Develop a standardized PPBE process that enables end-to-end (E2E) funds traceability and data linkage between planning, budgeting, and execution</td>
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</table>

**BIO** |
- ✔ |
- ✔ |
- ✔ |
- ✔

BIO’s mission best aligns with Goal 2.
FM Strategy Framework = Improved Decision Making and Business Outcomes

PROCESS

COMPLIANCE/CONTROLS
Compliance with laws, regulation and policies & adherence to documented business processes and IT general controls

STANDARDS
Adherence to documented standard end-to-end business processes, data, and exchanges

TECHNOLOGY
Simplified business IT systems and interface environment

PEOPLE
Staffing with right skill sets and resources

MGMT
Governance, risk management, policy, budget, and outreach

TARGET
Sustainable auditable business environment that is effective, efficient, secure, and affordable

- OMB A-123
- FISCAM
- SSAE-16
- MICP
- OMB A-136
- FFMIA
- P2P
- SFIS
- USSGL
- SV-8
- ERPs
- GEX
- GEX
FM Data Analytics Journey
Growth in Baseball Data

Pitchf/x
2008
Catch a Foul Ball Using Data Analytics
Data as a Strategic Asset – FM’s Cultural Change

Information as a Strategic Asset

Information as a Differentiator

Information to Enable Innovation

Information to Manage the Business

Data to Run the Business

Information Asset

Access to Data
Control of Data
Insight from Data

Business Value of Information

Information Management Maturity
Problem Solving Framework
How Do We Harness Data as a Strategic Asset?

- Process
- Technology
- People
DoD CIO Big Data Analytics

• Provides **Data as a Service (DaaS)** capability via a **Big Data** analytic platform with information from a wide range of Business and IT systems.

• Focused on solving two issues:
  – Analyzing spend: **Efficiencies and Savings**
  – Enabling financial audit: **Universe of Transactions**
What is Big Data?

High-volume, high-velocity, and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation. [Gartner]

• The 3 Vs: Volume, Variety, and Velocity
  – Volume: Think Petabytes – each Petabyte is a million Gigabytes (DISA manages 65 petabytes in DECCs)
  – Velocity: Think social media posts or phone records – billions of transactions
  – Variety: Think unstructured and structured – thousands of schemas

• Complexity Factors
  – Veracity
  – Aggregation security
  – Privacy
  – Provenance
  – Entity relationships
  – Usability

DoD’s Big Data has lower volume and velocity than some commercial operations, but extremely high variety.
What is Data Analytics?
Analytic Capability Maturity Model

*Adapted from Teradata*
DoD CIO Data Analytics Tenets

• To support and improve **data-driven decision making**, we provide best-in-class information and analysis through business intelligence and consultation.

• To support **data understanding**, we socialize the hidden business rules and policies that are used to create and store data from other field level and enterprise data stores.

• To support **data transparency**, we organize and build usable data models, provide data dictionaries and other documentation so clients better understand the strengths and limitations of data assets.
  – Analytic needs often uncover system deficiencies as people want to understand their data and workflows across systems.

• We promote a **business intelligence culture** in the DoD community.
  – We produce, maintain, and coordinate centrally available dashboards, analyses, and reports for the DoD community and work with key DoD functional leaders to maintain the best possible data.
What is a Data Scientist?

The role of the Data Scientist is central to a data culture.

A Data Scientist is...

A Business Analyst that lives in California.
Data as a Service (DaaS) Architecture

- Visualize & Publish: Tableau, Data-Driven Documents
- BYOT – Bring Your Own Tool
- SharePoint
- Persistent Data Layer
- Blend/Enrich
- Data Integration Virtualization Layer
- DataStar™
- Microsoft SQL Server
- Data Lakes:
  - IT MGMT
  - PROCUREMENT
  - FACILITIES
  - MANPOWER
  - FINANCIAL
- Raw Data:
  - DOD Data Sources
  - Machine Generated
  - eMail
  - Documents & Reports
  - Geo-location
- Research Sources:
  - CEB
  - Gartner
  - Forrester
  - IDC
- Standardized vocabulary & taxonomy
- Visualize & Publish
- 2014
DaaS process and data management methodology to support advanced data analytics capabilities.
Data sources currently span FM, Personnel, Manpower, Procurement, Logistics, IT Management, and Force Management.

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DaaS: Example Spend Analysis

- Analysis of vendors shows a highly interconnected environment.
  - Vendors selling to multiple agencies
  - Agencies buying from multiple vendors
- In FY17, most of wireless telecom spending was through large systems integrators and large prime contractors.
  - 9% of wireless telecom spend was on miscellaneous foreign contracts or other purpose-driven contracts.
The DoD CIO requested contract detail on products and services to GUAM. The resulting information showed that DON was the largest funder of contracts on Guam, and that the largest contracts performed on Guam were written to construction and facilities maintenance firms.
DaaS: FPDS – Contract Obligations per 4th Estate Agency or Activity

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<tr>
<th>Agency</th>
<th>Fiscal Year Obligations</th>
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<td>DLA</td>
<td>$26,203M</td>
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<td>MDA</td>
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<td>DoD (Other)</td>
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<td>Non-DoD</td>
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- DLA holds ~2x more in contract obligations as next largest agency/activity.
DaaS: FPDS – Small Business Usage

View from an all dashboard to explore contract obligations. Allows for quick, focused interrogation of data.

This example: How are we doing on Small Business contracting?

Choose a SBA Flag
Small Business

SBA Time Series

Percent of Dollars Obligated for Small Businesses and FY Goals

Agency
DaaS: FPDS – Contract Performance Location

Top Contracts

<table>
<thead>
<tr>
<th>Contract ID</th>
<th>Agency</th>
<th>Dollars Obligated</th>
<th>Number of Actions</th>
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<td>SPE4A1X6D0479-SPRTA116F0353</td>
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</table>
OUSD(C) Initiatives

Greg Little
So What Are We Doing in Comptroller?

Use Case #1

Use Case #2

Cost Management
UoT Problem

• The Department must support a Comprehensive Consolidated Audit.
  – DoD must be Audit Ready by end of FY17 per NDAA 2010.
  – DoD IG recommended creating a universe of financial transactions (UoT) from accounting and business systems to support financial statement audit.
  – OUSD(C) has documented the lack of the UoT as an audit deal breaker (i.e. SHOWSTOPPER).

• Additionally:
  – The DATA Act (Public Law No. 113-01) mandates “disclosing direct Federal agency expenditures and linking Federal contract, loan, and grant spending information to programs of Federal agencies to enable taxpayers and policy makers to track Federal spending more effectively”.

UoT Proof of Concept

✓ A single repository to support the existence and completeness of all Defense Wide Appropriation General Fund Data (TI-97) during the audit process, currently working SOCOM.
✓ Enables Component to improve operations by seeing reconciliation data.
✓ Provides DoD IG and auditors a single point of access.
✓ Implements commodity hardware, open source tools, and use of agile methods to accelerate traditional sampling and reconciliation.
What are we Building?

**Dashboard**
- Display match and balance variances for recons
- Drill down capability
- Tool readiness to support audit dashboard
- Variance workflow tracking
- Audit report generation
- Data lineage, business rules reporting, and data model

**Workbench**
- Ad-hoc query interface and export
- Enables analyst self-service data preparation, normalization and tabulation
- Enables custom visualization development (Tableau)
- Provides access to standard data science tools for ad-hoc statistical analysis and machine learning
- COTS integration

**Data Portal**
- Smart file intake web application for operational raw data ingest
- Scripted QA checking on ingest providing user feedback
- Error reporting and dashboarding
- MOA adherence tracking
- Metadata tracking

**Control Panel**
- JIRA, Confluence, and SharePoint integration for centralized PM stats reporting
- User permissions management
- User action, data query audit report
- IT operations dashboards

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**Single Sign-On Landing Page Provides Access to Extensible Framework of UOT Apps**

**Role and attribute base access controls inherited from UoT Security Model**
What have we Found?

- **Enterprise Resource Planning (ERP) financial systems produce superior results over legacy environments, most of the time.**
  - More details to support transactions and balances.
  - Implemented with compliant data structures (USSGL, Standard Financial Information Structure).
  - BUT, ERPs must follow their own leading practices (month end, no suspense accounts).

- **Feeder System and Financial System reconciliation accuracy depends on:**
  - Interface design, data exchanges, and business rules.
  - Disciplined, performance-driven processes.
  - Elimination of excess systems stops (don’t go from ERP to billing to disbursing to collecting to cash management to ERP).

- **There are multiple opportunities to expand common practices across implementations.**
  - System X uses the DCAS ID in their design but System Y does not, System X has better match rates.
  - Why do Army-State Department transactions work one way, but DSCA-State Department transactions work differently?
  - Why does one entitlement system produce better foreign currency results and matches?
  - Entity A uses JV’s to fix funds distributions at month end while Entity B does not.
# UoT Initial Findings - Example

<table>
<thead>
<tr>
<th>Contract Pay</th>
<th>DAI</th>
<th>EBS</th>
<th>EBAS-JS</th>
<th>EBAS-D</th>
<th>DEAMS</th>
<th>GAFS</th>
<th>GFEB</th>
<th>GFEBS</th>
<th>CEFMS</th>
<th>STARS</th>
<th>Navy ERP</th>
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</tbody>
</table>
Cost Management Problem

• **Problem**
  – Budget constraints demand smarter alignment of resources toward greater mission impact.
  – Existing DoD financial data is not efficiency organized to support effective managerial cost accounting to inform budget execution decisions at various levels across DoD.

• **Guiding Principles**
  – Apply corporate lens to highlight commercial best practices for decision support.
  – Deliver insights early to provide cost transparency up front.
  – Implement in 300 days.

• **Outcomes**
  – Transparency into spend and cost management.
  – Commercial-based cost management structure and dashboard.
  – Track, manage, and justify costs.
What is the Process?

1. Define the Cost Decision Framework (CODE)
   - Identify key segments which drive business decision making (e.g., product segments such as Custodial)
     - Based on commercial best practices, but designed based on DoD considerations
   - Delineate priority data needs
     - Materiality, Actionability, Variance—in order to define where validation for higher reliability is necessary

2. Create and populate CODE
   - Implement data call of existing DoD obligation and expenditure data
   - Where actual data unavailable or unreliable, use estimates to impute missing values
   - Use commercial references to allocate cost from installation to facility
   - Prioritize list of identified data issues where investing to improve or pursue actual data provides higher utility than using estimates

3. Manage cost performance
   - Develop implementation plan
     - Define target operating model for how DoD will deploy the solution
     - Improve data quality/completeness
     - Design a data housing solution
     - Derive the value proposition through a series of use cases
What have we Found?

The real property effort showing potential to unlock managerial insight

<table>
<thead>
<tr>
<th>Identification of internal best practices</th>
<th>Budgeting / opportunity sizing</th>
<th>Assessing total cost of ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custodial $ / sq. ft., Installation A vs. Installation B</td>
<td>Electricity $ / sq. ft., All installations</td>
<td>Maintenance &amp; repair $ / sq. ft., DoD vs. commercial reference</td>
</tr>
</tbody>
</table>

Questions to consider

What is driving disparity in custodial cost at similar installations?  
Is there an opportunity to establish budget parameters on electricity spend that normalizes portfolio performance?  
Is underinvestment in replacement relative to commercial reference driving up unscheduled maintenance?
Visualization of data can help identify priority outliers

This insight into the outliers helps drive improvements either in data quality or performance, by identifying:

- Misrepresented estimations, especially averages
- Systemic errors, improper data collection
- Improper procedures; over/under pay
- Improper bookkeeping; large clusters of similar values (0’s)

For Example: CAMP LEMONNIER DJIBOUTI records all costs based on the associated BOS contract under Custodial – should we fix issue at the transactional layer or develop an estimation leveraging CODE?
Lessons Learned

• Modern technologies and tools have made formerly near-impossible things doable relatively cheaply.

• Innovation in DoD is an uphill climb, and there is no tail wind.

• While technology and tools can help, most problems are policy, process, and people challenges.

• Evolution of IT over the past 50 years has led to an extremely complex FM environment.

• UoT project is proving that with the right people and right (agile) approach, modern “Big Data" technologies can help solve large/complex problems in an affordable way.
Backup
Our Capital Assets…

- Human Capital
  - Skills
  - Expertise
  - Knowledge
  - Creativity

- Information Asset
  - Access to Data
  - Control of Data
  - Insight from Data

- Assets
  - Property
  - Inventory
  - Equipment
  - Cash
"After careful consideration of all 437 charts, graphs, and metrics, I’ve decided to throw up my hands, hit the liquor store, and get snookered. Who’s with me?!"
Business Information Chaos

Information explosion and silos
  Volume, variety, velocity
  Multiple financial & feeder systems
  Lack of uniform standards

People spend time finding information
  Can’t find, don’t trust what they find,
  and don’t know what to do with it

Retirement and disposition policies not enforced
  Kept forever... destroyed too soon

Management by spreadsheet
  Proliferate out of control

High Cost, Lack of Confidence, High Risk
Big Data Analytics Architecture Example

*Adapted from Teradata*
DaaS: Data Management Infrastructure

BYOT – Bring Your Own Tool

Data Infrastructure

2014 Microsoft SQL Server

DataStar™
What is Data Science?

• Data science is the study of where information comes from, what it represents, and how it can be turned into a valuable resource in the creation of business and IT strategies.

• Mining large amounts of structured and unstructured data to identify patterns can help an organization:
  – Rein in costs
  – Increase efficiencies
  – Recognize new market opportunities
  – Increase the organization's competitive advantage

Source: [http://searchcio.techtarget.com/definition/data-science](http://searchcio.techtarget.com/definition/data-science)

• Attributes include:
  – Iterative process that is well documented over many years.
  – Data Scientist (like "Cloud") is a term that covers many different sets of skills.
  – Execution is a step-wise process and expertise grows over time (by task and by domain).
  – Produces actionable / decision-making information or program costs cannot be justified.
  – Devil is in the details.
Data as a Service (DaaS)

- DoD CIO Data Analytics began as a pilot effort in 2014 – and evolved to DaaS capability offering to OSD.
- Decision making requires access to decision-quality information.
- Ongoing Data Analytics effort producing results now on targeted pieces:
  - Provides huge improvement in transparency/visibility.
  - Provides quantum leap in IT management/metric capability.
  - Augments existing data collection and reporting efforts.
- Expanding Data Analytics effort is beneficial to Defense Business Council, Joint Information Environment, Cybersecurity, C4 efforts, and others.
Data as a Service and the Big Data Process requires growing, leading, and managing new skill sets, including Data Scientists.

*Adapted from Big Data and it's Technical Challenges, ACM July 2014, vol 57, no. 7*
Data Science Process
Tools and Technologies
Tools and Technologies

- **Complexities:**
  - Structured vs. unstructured data
  - Real time data access
  - Processing speed
  - Data storage
  - Audit
  - Hardware platforms
  - Tools – open source or proprietary
  - Ease of use
  - Costs
  - Self-service
  - Governance
  - Metadata management
  - Cloud BI
DaaS: Example Spend Analysis

- Analysis of vendors shows a highly interconnected environment.
  - Vendors selling to multiple agencies.
  - Agencies buying from multiple vendors.
  - Numerous small contracting actions increase administrative costs.
- In FY13, most of wired telecom spending was through large systems integrators and large prime contractors. Includes professional services, engineering, etc.
- 61% of telecom spending was through DISA, but there are many instances where agencies engaged vendors directly.

Results are from Deloitte mining of FPDS-NG and TIBI data and need validation.
DaaS: Example Spend Analysis

- Single Largest Obligation ($6,050,008) is one wireless contract to AT&T, funded and contracted by DCMA
- Other DoD is comprised of OSD/WHS and other activities.
DaaS: Example Spend Analysis

Defense Logistics Service Contracts for FY 15 - 16

NAICS Distribution (What the Vendor can Sell)

<table>
<thead>
<tr>
<th>NAICS Description</th>
<th>Fiscal Year 2015</th>
<th>Fiscal Year 2016</th>
<th>Grand Total</th>
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<tbody>
<tr>
<td>OTHER COMPUTER RELATED SERV...</td>
<td>$312,393,942</td>
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<td>OTHER WAREHOUSING AND STOR...</td>
<td>$286,017,973</td>
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<td>COMMERCIAL AND INSTITUTIONAL...</td>
<td>$245,629,045</td>
<td>$192,882,078</td>
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<td>OIL AND GAS PIPELINE AND RELAT...</td>
<td>$114,049,641</td>
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<td>COMPUTER SYSTEMS DESIGN SER...</td>
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<td>OFFICES OF CERTIFIED PUBLIC AC...</td>
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<td>ADMINISTRATIVE MANAGEMENT A...</td>
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<td>REMEDIATION SERVICES</td>
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<td>SUPPORT ACTIVITIES FOR OIL AND...</td>
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<td>ENGINEERING SERVICES</td>
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<td>INLAND WATER FREIGHT TRANSP...</td>
<td>$33,241,837</td>
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<td>RESEARCH AND DEVELOPMENT IN...</td>
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<td>JANITORIAL SERVICES</td>
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<td>FACILITIES SUPPORT SERVICES</td>
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PSC Distribution (Service bought)

<table>
<thead>
<tr>
<th>Product or Service Description</th>
<th>Fiscal Year 2015</th>
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<th>Grand Total</th>
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<tbody>
<tr>
<td>IT AND TELECOM- IT STRATEGY AND ARCHITECTURE</td>
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Data Confidence Rating: 3/9