



Department of the Navy

Strategy for Data and Analytics Optimization

15 September 2017

Foreword

The *Department of the Navy Strategy for Data and Analytics Optimization* marks the starting point of our discourse, discovery, learning, and transformation in data and analytics. It communicates the actions the DON Chief Information Officer (CIO) will take in order to integrate and optimize policies, people, processes, information, and technology to sustain the DON's information edge. The optimization strategy relies heavily on community participation to help define the most effective policies, generate innovative solutions with tangible values, and share lessons learned, best practices, data, and solutions. The DON CIO looks forward to your support and participation in this critical effort.

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Chief Information Officer
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1 INTRODUCTION

1.1 What are data and analytics? Data and analytics are critical strategic and operational assets for the Department of the Navy (DON). Data refers to the representation of facts, concepts, or instructions in a formalized manner. Analytics is the product of systematic data analysis, used to support evidence-based decision-making.

1.2 Why do they matter? We are in a global competition to gain better insight and foresight from data. Collecting and analyzing data are fundamental to our everyday work, from intelligence and engineering operations afloat, to budgeting and Cybersecurity risk management. The explosion of data-driven innovations from commercial industry presents the DON with a great opportunity to enhance its mission performance. The DON must keep pace with technology advancements and make better use of the Department's vast and growing data resources.

1.3 What is the vision? The DON will have the knowledge and capability to securely leverage the data and analytics assets of the DON enterprise to enhance our combat capabilities, increase our operational efficiencies, and improve our ability to make evidence-based decisions quickly.

1.4 How? It will take a group effort and it will involve incremental steps. The first step is to build partnerships and organizational knowledge within the DON. To do that, we will form a DON Data and Analytics Consortium (DAC) to channel related efforts toward a common vision, to analyze policy constraints and needs, and to establish workforce training and certification requirements. From this foundation, the DON will take further measured and methodical steps toward optimized data and analytics.

1.5 What do I need to do? Learn, participate, and work together. It is important for all DON personnel to understand data, analytics, and evidence-based decision making. It is essential that DON organizations participate and contribute to the Data and Analytics Consortium, by sharing knowledge and learning from each other. However, responsibility for this effort resides with every individual in the DON for the benefit of our everyday work, and our contributions to the Department's mission.

1.6 Who? The *DON Strategy for Data and Analytics Optimization* is applicable to the offices of the Secretary of the Navy (SECNAV), the Chief of Naval Operations (OPNAV), the Commandant of the Marine Corps (HQMC), and all subordinate organizations. This strategy is applicable to all DON Mission Areas.

2 BACKGROUND

2.1 Commercial innovations in information technology continue to stimulate the imaginations of the DON warfare and business communities. The way commercial industry collects, processes, and provides innovative services with data is especially intriguing. Being able to collect and make use of vast amounts of data has been the differentiator for recent business and political achievements. For example, Amazon has achieved phenomenal success as an online retailer. Amazon's ability to collect data through its devices and services, then process collected data into actionable information, has been a game-changer in the retail industry.

2.2 Information and intelligence have been critical elements of warfare for a very long time. Knowing just a little bit more, or being able to recognize false signals slightly better than an adversary, have tipped battles and wars throughout history. Having just a little more insight to support our financial investment and acquisition decisions has also given us an edge in our military strength. The DON and the wider U.S. military have a rich history in using data in this regard, and have contributed greatly to the foundational scientific research that is enabling the era of "Big Data" analytics. However, we cannot rest on what has been done. The reality is that industry and commercial data capabilities have surpassed our own. If we do not act to adapt these commercial capabilities, methods, and standards, we risk losing our information edge over our competitors and adversaries.

2.3 Hypothetically, imagine we had a supply chain like Amazon. We would be able to collect supply data in an automated manner instead of manual data entry. We would be sharing our data across the Defense Department to optimize our supply chain and store inventory at the optimal locations to support logistical needs. We would also be able to accurately forecast military demands and share them with suppliers.

2.4 Should we have emergent requirements or changing demands, we could immediately make changes and disseminate the information to suppliers. Suppliers would be able to right-size manufacturing throughput to maximize their profits as they better meet our demands. We would be able to minimize inventory and logistics delays, and lower overall costs. Imagine being able to deliver necessary parts and supplies to naval waterfront workers within hours of finding an unexpected failure.

2.5 Envision a work environment where administrative reporting and routine administrative tasks are automated through sensors, sharing, and machine learning capabilities. We would be able to disseminate information instantaneously, make decisions faster and better, and learn and adapt faster. We could better use our limited resources to perform value-added tasks, such as replacing water pumps —instead of doing paperwork about replacing water pumps. We could focus more on improving mission performance and coming up with innovative solutions to problems, instead of performing routine data gathering, compliance reviews, and reporting.

2.6 There are countless opportunities for improvement through data and analytics. We must act quickly to foster a culture of data-driven innovation, and structure our policies and workforce appropriately to deploy and operate innovations with minimal time-to-market.

3 VISION AND GOALS

3.1 Optimization Vision:

3.1.1 The Department will have the knowledge and capability to securely employ the data and analytics assets of the DON enterprise to enhance our combat capabilities, increase our operational efficiencies, and improve our ability to make evidence-based decisions quickly. The DON will be able to:

- Predict and inventory the right data and analytics assets to meet the demands of DON data consumers and decision makers,*
- Rapidly create or procure innovative solutions to meet emerging demands,*
- Deploy and operate innovative solutions with minimal time-to-market.*

3.1.2 The DON will right size its data collection, analytics, application portfolio, and infrastructure to meet the demands of data consumers and decision makers. All data collected within the DON will be visible, accessible, understandable, trusted, and interoperable for authorized users. The DON will be able to use the DoD Information Enterprise (IE) and Joint Information Environment (JIE) infrastructure to exchange data within the DoD Information Network (DODIN). (References (a), (b), (g), and (h)). Additionally, the DON will be able to employ the Intelligence Community Information Technology Enterprise (IC ITE) to exchange data at the Sensitive Compartmented Information (SCI) level with designated IC mission partners. All data exchanged by the DON via IC ITE will align with IC data standards and comply with applicable IC directives. In the optimized state, DON data consumers and decision makers will have access to the complete inventory of quality data and analytics assets required to support their mission roles at any time, from anywhere.

3.2 Goals:

3.2.1 To achieve the optimization vision, the DON will take a platform-building approach consisting of three major goals:

- **Goal 1 – Establish a Data and Analytics Consortium (DAC)**– The DON needs to interact better internally and externally, to make all our data work for all of us and to integrate our ideas to generate new innovations. There are technical issues we need to tackle together, but there are also cultural barriers that need to be overcome. Social interactions and group-based learning build trust. Necessary policies, oversight, and workforce requirements for sharing and integrating our data, analytics, and ideas should originate from this “community of trust.”
- **Goal 2 – Learn open source technology** – It is paramount that we become able to adapt faster to data-driven innovations, create new innovations, and deploy those innovations. Increasingly, industry and academia are accomplishing this through open source standards, tools, and methods. Open source standards might not be the best solution for every situation in the DON. However, we need to learn about and understand them to understand where these state-of-the-art capabilities and knowledge fit in our portfolio.
- **Goal 3 – Adopt a common data management framework** – This is critical to improving our readiness to deploy innovations. Instead of waiting until a requirement arises to determine what we have and how to implement our new idea, good data management would complete the necessary hard work ahead of the time. The DON is adopting the National Information Exchange Model for reusing and sharing data models, a very important first step to improving data management.

4 OPTIMIZATION ROADMAP

4.1 The DON will take a methodical and measured approach to achieve the stated optimization vision and goals. This approach will be based on the Data Management Maturity (DMM) model developed by the Capability Maturity Model Integration (CMMI) Institute. The DON will use the DMM’s five maturity levels and outcomes as reference points for incremental improvement. Table 1 below provides a summary of the DON Data and Analytics Optimization Roadmap based on the DMM, containing the five maturity levels, a description of the outcome for each maturity level, and the actions, or “outputs” required to achieve each maturity level. The five maturity levels, outcomes, and outputs are discussed in detail in *Appendix A – Optimization Roadmap Outcomes and Outputs*.

Table 1, DON Data and Analytics Optimization Roadmap (Derived from Mecca, Melanie, *Data Management Maturity Model Introduction*, CMMI Institute December 2014)

DMM Level	Outcome	Outputs
1: Performed	Data is managed as a requirement for the implementation of projects/programs. Processes are performed ad-hoc, primarily at the project/program level. Process discipline is primarily reactive.	Status quo
2: Managed – Building Partnership and Knowledge	There is awareness of the importance of managing data as a critical infrastructure asset. Processes are planned, executed, and evaluated in accordance with policy; employ skilled people having adequate resources to produce controlled outputs.	2.1 – Standup the Data and Analytics Consortium
		2.2 – Develop initial training curriculum and workforce guidelines
		2.3 – Develop Data Operations Guide
		2.4 – Develop an outreach platform through DAC
3: Defined – Defining Governance and Workforce Policies	Data is treated at the DON enterprise level as critical for successful mission performance. Sets of standard processes have been established and improved over time, providing a predictable measure of consistency.	3.1 – Build DON IM/IT data prototype
		3.2 – Update relevant IM/IT policies
		3.3 – Analyze and update requirements policies
		3.4 – Develop a DAC training and certification program.
4: Measured – Leveraging Data and Analytics Assets	Data is treated as a source of competitive advantage. Managed and measured process metrics have been established. There are formal processes for managing variances.	4.1 – Develop data savvy training modules
		4.2 – Develop standard acquisition deliverables
		4.3 – Develop DON organizational data strategies
		4.4 – Develop DON data and analytics asset catalog
5: Optimized – Innovating and Continuously Improving	Data is seen as critical for survival in a dynamic and competitive environment. Process performance is continually improved through both incremental and innovative improvements. Feedback is used to drive process enhancements and business growth. Best practices are shared with peers and industry.	5.1 – Drive continuous service improvement of data and analytics. Make additional strategy and policy updates as required.

5 STRATEGIC PRINCIPLES

5.1 The ten strategic principles outlined below provide the strategy's highest level guidance for implementation. DON communities and programs will use these strategic principles to align data strategy planning efforts, enterprise architecture design efforts, and system/solution development efforts to this strategy.

1. **Knowledge** – The DON must achieve appropriate organizational knowledge in data and analytics. We require specialists with the right skillsets to develop and operate data-driven capabilities. The DON workforce as a whole requires enhanced training in data and decision sciences to make more effective use of these capabilities.
2. **Sharing** – Sharing is critical to our mission success, innovation, and scientific discovery. DON data, information, and services are Federal Government assets, and will be shared as needed and authorized (references (a) and (b)).
3. **Cybersecurity** – Securing the DON's data is a matter of national security. Cybersecurity shall be built into all information architectures to ensure the right levels of availability, data integrity, confidentiality, authorization, and access.
4. **Privacy** – Protecting the personally identifiable information (PII) of all DON personnel is important to their privacy and security. PII shall be protected according to relevant laws, regulations, policies, and guidance (LRPG) (references (c) and (d)).
5. **Open Source** – The use of open source will aid in achieving the DON's data and analytics optimization vision faster. Open source tools, methods, and standards will be adopted for the Department's research and training in data and analytics.
6. **Standardization** – To harness the capabilities of aggregated data, common data standards and information exchange models are necessary. In alignment with Federal and Department of Defense (DOD) directives, DON organizations and programs will adopt National Information Exchange Model methods to share and re-use data standards (references (e) and (z)).
7. **Decision Demand** – Data collection shall be based on the demand for data to support specific decision needs.
8. **Collection Design** – Data collection design shall consider data veracity, relevance to the decision hypothesis, data volume and velocity necessary to support the decision, bandwidth and connectivity limitations, and the cost and burden of collection. Manual entry for data collection shall be strongly avoided (reference (z)).
9. **Authoritative Evidence** – It is important that decision making be supported with authoritative and trusted sources of evidence. All DON personnel must contribute to the veracity of authoritative data sources (ADS), and help to ensure compliance with records management LRPG (references (a), (b), and (f)).
10. **Data Rights** – It is essential to specify the appropriate requirements for data deliverables and data rights when procuring products and services for the DON. It is necessary to ensure the DON's right to use data assets from acquired products and services, and to control data distribution.

6 APPENDIX A – OPTIMIZATION ROADMAP OUTCOMES AND OUTPUTS

6.1 The *DON Data and Analytics Optimization Roadmap* descriptions outlined in Table 1 are provided below. It contains the roadmap’s maturity levels, outcomes, and outputs.

6.2 Status Quo – DMM Level 1

6.2.1 The current state of the DON information enterprise is best described by DMM Level 1 – “Performed.” At this level, data is managed as a requirement for the implementation of projects and programs, and data management process disciplines are primarily reactive.

6.2.2 Action is necessary to advance beyond the current state.

6.3 Building Partnership and Knowledge – Reaching DMM Level 2

6.3.1 Desired Outcome:

An awareness of the importance of managing data as a critical infrastructure asset. Processes are planned, executed, and evaluated in accordance with policy; skilled people having adequate resources produce controlled outputs.

Outputs required:

- Stand up a DON Data and Analytics Consortium (DAC). Develop terms of reference (TOR) to facilitate a common vision, constitution, and bylaws; and outline the appropriate membership, roles, and responsibilities.
- Develop initial DAC training curriculum and workforce guidelines, employing an open source DON data and analytics environment.
- Develop a data operations guide that documents the LRPG that govern data operations and the procedures necessary for compliance.
- Through the DAC, develop outreach to high tech companies, academia, and other government organizations.

6.3.2 As noted, the first step toward the target state is to build partnerships and organizational knowledge within the DON. The DAC will be instituted as part of the Naval Innovation Network, to build a coalition to channel related efforts toward a common vision. The consortium will act as the forum for data sharing and analytics, and to respond to data and decision demands, share best practices, collaborate on related research. The DAC will also promote the governance, standards, training, and policies necessary to achieve data and analytics optimization. A DAC terms of reference (TOR) will facilitate a common vision, constitution, and bylaws, and outline the appropriate membership, roles, and responsibilities.

6.3.3 A Data & Analytics Optimization (DAO) program under the office of the DON CIO will execute the required actions, steered by the DAC’s requirements for policies, standards, methods, and tools. Initially, the program will work to establish a DAC training curriculum and workforce guidelines, employing an open source environment for hands-on training and rapid prototyping of data analytics products. The analytics products and data sets stored in the environment will be available for re-use. Rapid prototyping will focus on turning out tangible and useful products for trainees’ home activities, enhancing the culture and knowledge of the DON’s data operations, and facilitating data-driven innovation. Rapid prototypes will serve as test beds to analyze and

work within LRPB requirements. A Data Operations Guide will be developed and maintained to document the standard checklist and procedures for LRPB compliance.

6.3.4 Additionally, the DAC will be a platform for outreach to industry, academic, and government research centers. This will help the DON stay abreast of technical advances and gain acceptance as a serious partner/stakeholder in this field.

6.4 Defining Governance and Workforce Policies – Reaching DMM Level 3

6.4.1 Desired Outcome:

Data is treated at the organizational level as critical for successful mission performance. Sets of standard processes have been established and improved over time, providing a predictable measure of consistency.

Outputs Required:

- Develop a working data prototype to address the DON's IM/IT data challenges.
- Update DON enterprise architecture (EA) to emphasize governance and integration of DON's data and analytics assets. Update portfolio management policies with material on data and analytics asset management. Bring unstructured data and analytics assets under management.
- Update the DON's Defense Business System and Joint Capability Integration Development System implementations to effect better consideration of data requirements by acquisition programs.
- Expand the initial DAC training curriculum into a DAC training and certification program. Ensure appropriate manpower, training, and knowledge requirements to achieve the data and analytics optimization vision.

6.4.2 To achieve DMM Level 3, the DON will need to update DON IM/IT governance processes and tools, and create an integrated DON IM/IT governance data environment. This will address the DON IM/IT community's own data challenges in its effort to support of the Department's data and analytics vision.

6.4.3 The DON EA will be aligned with the DAO program, to focus on governance and integration of the DON's data and analytics assets. Data and analytics asset management will become part of the DON's portfolio management policy and future updates (references (i) and (j)). Management of unstructured data assets and the associated analytical tools will be brought under the DON EA and portfolio management. The Department's implementation of Joint Capability Integration and Development System (JCIDS) and Defense Business System (DBS) processes will be analyzed and updated to serve decision needs (references (k) and (l)).

6.4.4 The DAC training curriculum will be expanded into a training and certification program. The program will ensure that the Department has appropriate manpower, training, and knowledge requirements to achieve the data and analytics optimization vision. Data operations and analytics services will only be performed by personnel with the required training and certification.

6.5. Leveraging Data and Analytics Assets – Reaching DMM Level 4

6.5.1 Desired Outcome:

Data is treated as a source of competitive advantage. Managed and measured process metrics have been established. There are formal processes for managing variances.

Outputs Required:

- Develop and provide appropriate levels of training in data and decision sciences to DON personnel to create a data savvy workforce. Expand the DAO training and certification program to include analytics operations training and certification requirements.
- Develop and enforce National Information Exchange Model (NIEM) adoption by new acquisition programs and incorporate the architecture specifications into the DON EA (would not include systems already in operation and maintenance).
- The DON Secretariat, OPNAV, and HQMC will develop executive-level data strategies in alignment with the DON Strategy for Data and Analytics Optimization.
- Add an enterprise data and analytics catalog to the DON EA.

6.5.2 With the essential organization, policy, governance, and training in place, the DON will concentrate on fostering a culture that effectively employs data and analytics assets. To support the creation of a data savvy workforce, role-appropriate training modules will be provided for all DON personnel (reference (w)).

6.5.3 To better exploit data and analytics assets, the DON DAO program will assist DON organizations in developing data strategies. These strategies will document the decision demands and data requirements of data consumer communities, including the management of their unstructured data assets. First, the DAO will assist with executive-level data strategies for the Secretariat, OPNAV, and HQMC (reference (m)), then work with Echelon II organizations. Navy Echelon III and USMC Major Force Commands will be a stretch goal. The decision demands and data requirements captured in these data strategies will be aggregated to build the DON data and analytics catalog and added to the DON EA.

6.5.4 The DON EA, including the data and analytics catalog and specific data strategies, will be used in developing acquisition program solution architectures. Every new acquisition program will be required to adopt the NIEM methodology for sharing and re-using data models, and to demonstrate that a standardized data deliverable is on its Contract Data Requirements List. These data deliverables will be incorporated into the DON EA. Use of the DON EA, and enforcement of the NIEM methodology in new acquisition programs will gradually transform the DON's IT capabilities into an integrated enterprise information environment.

6.6 Innovating and Continuously Improving – Reaching DMM Level 5

6.6.1 Desired Outcome:

Data is seen as critical for survival in a dynamic and competitive environment. Process performance improvement is continuous, involving both incremental and innovative advances. Feedback drives process enhancements and business growth. Best practices are shared with peers and industry.

Output Required:

- The DON will update strategy and an associated policy with lessons learned, and is able to self-organize for data and analytics optimization without top-down direction.

6.6.2 The DON will aim to reach a state in which the enterprise learns continuously and uses learned information to self-organize for faster and better insight without top-down direction. The DON will keep challenging the status quo, continue to rapidly adapt commercial technologies and best practices, and invest in data and analytics innovations that will result in improvements to its warfighting, business, intelligence, and IT capabilities. The DON DAC will continue to provide the common platform for optimization.

7 APPENDIX B – BASIC CONCEPTS

7.1 The following basic concepts are listed as simple language to support common understanding of the DON's strategy and approach to data and analytics optimization. They are not presented as authoritative definitions.

7.2 Data

7.2.1 Data is the “representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automated means (official DON definition adapted from FIPS Pub 11-3).” Data is commonly collected in one's personal and professional life. Filling out a medical form during a doctor's visit, using the search engine on a device, or making entries on a timesheet are examples of how individuals routinely provide data for collection.

7.2.2 Information provided on a medical form assists a physician in making treatment decisions. Internet providers may use your search history, coupled with your personal profile and demographic and other information, to target you for personalized advertisements. Workplace managers can use aggregated timesheet information to inform human resources, budgeting, and funding decisions.

7.2.3 Advancements made in recent decades have led to data collection and use becoming increasingly automated, enabling artificial intelligence capabilities based on machine learning and machine-to-machine communications known as the Internet of Things.

7.3 Big Data

7.3.1 “Big data” is the term used to describe data sets with high volume (large sample size), variety (many types, categories), and velocity (high speed collection, cleansing, and integration). The size and complexity of big data demands modern data technology to process it (reference (z)).

7.4 Data Science

7.4.1 Data science is the study of data. It is considered a continuation of the fields of applied statistics, data mining, data management, data fusion, and operations research; often dealing with big data sets requiring special processing technology. Data science includes both structured and unstructured data. (Definition derived from Dhar, Vasant; *Data Science and Prediction*, Communications of the ACM Vol. 56 No.12 Pages 64-73)

7.5 Structured and Unstructured Data

7.5.1 Structured data has a pre-defined data model or is organized in a pre-defined manner. Many IT systems are developed to support data collection in structured formats, for easy aggregation and processing.

7.5.2 Unstructured data does not have pre-defined models or organization. Free-text information sets, such as this document, are unstructured and traditionally difficult for computers to understand and process. However, the latest advances in artificial intelligence and natural language processing are making drawing intelligence and developing analytics from unstructured data much easier.

(Definitions derived from Grimes, Seth, *Structure, Models and Meaning*, <http://www.informationweek.com/software/information-management/structure-models-and-meaning/d/d-id/1030187?>, February 2005)

7.6 Data, Information, Knowledge

7.6.1 Figure 1 below shows the pyramid widely used to represent the hierarchical relationships of Data, Information, and Knowledge (DIK). In this hierarchy, data and information are considered evidence used to support decision-making. Knowledge represents the understanding of information in the context of a decision with personal know-how, experience, intuition, and insight. Human judgment and decisions are typically made based on knowledge with the inference of relevant evidence (data and information).

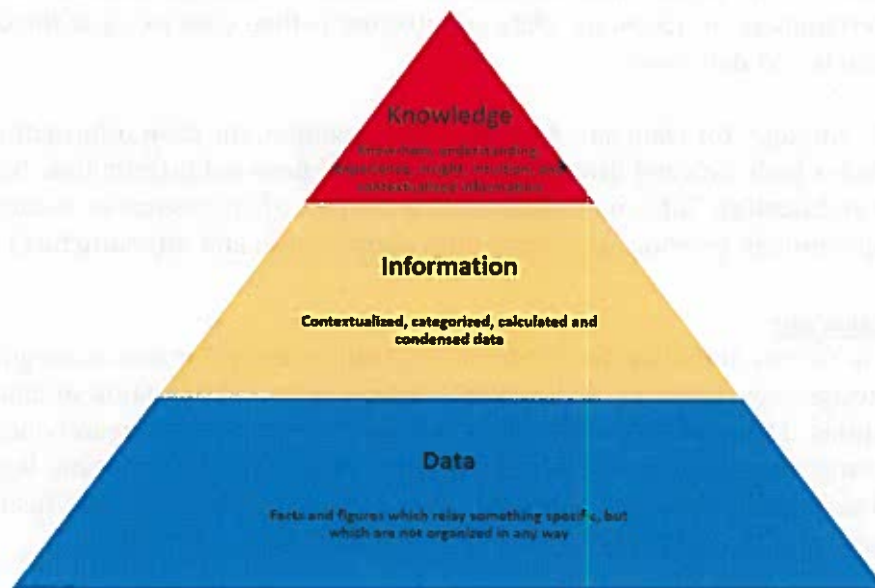


Figure 1, Data, Information, Knowledge Pyramid, adapted from http://www.knowledge-management-tools.net/images/Knowledge_pyramid.png

7.7. Data Operations

7.7.1 The DON employs “data operations” as the general term to describe an interdisciplinary competency involving enterprise data management, information architecture, and data engineering. DON data operations will efficiently harness and manage aggregated data capabilities to support the Department’s engineers, analysts, scientists, warfighters, and decision-makers. Data operations is viewed as a component of IT operations.

7.8 Data Management

7.8.1 According to the Data Management Association International (DAMA), data management is the development, execution, and supervision of plans, policies, programs, and practices that control, protect, deliver, and enhance the value of data and information assets.

7.8.2 DAMA's body of knowledge (DMBOK) defines an industry standard view of data management functions, terminology, and best practices, without prescribing specific methods and techniques.

(Definitions adapted from <http://dama.org>)

7.9 Information and Data Architecture

7.9.1 Information architecture and data architecture are synonymous concepts, often used interchangeably to describe the collaborative design process necessary to collect, store, arrange, and exchange data and information.

7.9.2 Some references and people differentiate the terms. When they do, they use information architecture to describe the higher order concept of information design, to mean the material we consume for entertainment or decisions. Data architecture is then used to mean the design of physical data models and databases.

7.9.3 In the DON Strategy for Data and Analytics Optimization, the term information architecture includes both data and information design, and does not differentiate between data and information architecture. Information architecture is part of an enterprise architecture, along with business, operational, mission, and technology (application and infrastructure) architectures.

7.10 Data Engineering

7.10.1 There is no formal definition for the term "data engineering." It is an emerging term used to describe the design, development, deployment, sustainment, and operation of data and analytics capabilities. This includes engineering capabilities, such as data warehousing, data lakes, big data computing (such as Hadoop and Spark), and in-RAM computing. It also includes service-oriented tasks such as extract, transform, load (ETL); data mining, data fusion, data cleansing, data preparation, data visualization, and database administration.

7.11 Authoritative Data Source and Master Data

7.11.1 DOD defines an authoritative data source (ADS) as "a recognized or official data production source with a designated mission statement or source/product to publish reliable and accurate data for subsequent use by customers. An authoritative data source may be the functional combination of multiple, separate data sources" (reference (x)). DOD's ADS definition is synonymous with the industry term "master data."

7.11.2 The definition of ADS or master data must be differentiated from the term, *authoring source* or *original data source*, which is where the data is originated.

7.12 Analytics and Business Intelligence

7.12.1 Analytics is a form of information, resulting from the systematic analysis of data or statistics (adapted from <https://en.oxforddictionaries.com/definition/analytics>). Analytics is specifically useful for visualizing large volumes and varied aggregations of data in useful formats. Increasingly, analytics has been able to produce decision-support products and services from unstructured data.

7.12.2 Analytics can be descriptive, predictive, or prescriptive. Descriptive analytics is the most basic type, the foundation for the other two. Descriptive analytics represents the observations captured in data as metrics or graphs, such as summary statistics of averages and totals or conditional probabilities. Sometimes the term “cognitive” analytics is used for a descriptive analytics capability that uses observations from multi-dimensional data sets to provide more intricate insight. Predictive analytics uses mathematical models developed from existing data and their descriptive analytics to forecast trends or predict the likelihood of future events. Prescriptive analytics uses models that go beyond calculating likelihood of future events, combining that with utility functions to determine the course of action that will lead to the best expected outcomes. The field of operations research is especially focused on prescriptive modeling for problem solving.

7.12.3 “Business intelligence” is a term synonymous to analytics, though more tied to a specific IT capability, such as a web dashboard that pulls data from a variety of sources to produce a descriptive visualization/representation.

7.13 Information Technology

7.13.1 “Information technology” is any equipment or interconnected system or subsystem of equipment used in the automated acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information. (Reference (h)).

7.14 Cybersecurity

7.14.1 “Cybersecurity” is the securing of data and information in IT systems. Cybersecurity is a growing concern, due to the ever-increasing amount of data collected and the open nature of the internet (reference (n)).

7.15 Information Management Considerations

7.15.1 DON data operations have critical areas that are typically aligned to the professional discipline of information management. These considerations include protection of personally identifiable information and privacy, management of requests made under the Freedom of Information Act, Federal Government records management, and knowledge management (references (c), (d), (f), (p)).

7.16 TCPED-FA

7.16.1 “TCPED-FA” stands for tasking (need), collection, processing, exploitation (capitalization, utilization), dissemination (sharing), fusion (aggregation, integration), and analysis (analytics, reporting). It is the data lifecycle model used by the Intelligence Community.

7.17 John Boyd’s Observe, Orient, Decide, Act (OODA) Loop

7.17.1 John Boyd’s *observe, orient, decide, act* (OODA) loop is widely used to describe the human process of decision making. Simply described, a human will first observe a situation, then orient the observation, then make a decision based on the orientation, and finally act according to the decision. Experience learned from the OODA process and the result of the consequent action creates feedback to inform future OODA processing.

7.17.2 Data and analytics products and services mainly support the *observe* and *orient* stages of the OODA loop. *Observe* includes data collection through both human and machine sensors. *Orient* includes data analysis and fusion to support decision-making.

7.17.3 The *observe*, *orient*, *decide*, and *act* stages all contain certain degrees of uncertainty. Decisions that appear sound based on available evidence do not always lead to anticipated outcomes. It is thus critical to minimize uncertainty through thorough and effective data operations leading to accurate, precise, and user-friendly analytical products and services.

7.18 Sharing of Data, Information, and Services

7.18.1 DoD's net-centric data strategy calls for sharing of data, information, and services. The strategy requires all DOD activities to make their data discoverable, accessible, understandable, trusted, and interoperable to all authorized users. Sharing of data, information, and services underlies the aggregation of data to enable data-driven capabilities. More information on this topic is available in references (a), (b), and (o).

7.19 Net-Centric Operations

7.19.1 In Net-centric operations, netted sensors and collective information capabilities support operational activities and distributed warfighting capabilities. Due to increasing dependence on connectivity, and the potential damage that could result from attacks, critical capabilities must have continuity of operation plans or the ability to remain operational while disconnected (references (o), (q), (r), (s), (t), and (z)).

7.20 National Information Exchange Model (NIEM) Methodology

7.20.1 NIEM is the United States Government standard for data sharing and re-use. NIEM "connects communities of people who share a common need to exchange information in order to advance their mission" (reference (e)).

8 APPENDIX C – ROLES AND RESPONSIBILITIES

8.1 DON CIO

8.1.1 The DON CIO, as the Department's senior official for information management (IM), information technology (IT), and information resources management (IRM), presides over the DON's DAO program and policies, and operates the DON DAC (reference (y)).

8.2 DON Deputy CIOs

8.2.1 The DON Deputy CIO (DDCIO) Navy and DDCIO Marine Corps will support the DON CIO by implementing the data and analytics optimization program and policies within their respective Services and the Services will participate in the DON DAC.

8.3 ASN (RD&A)

8.3.1 Assistant Secretary of the Navy (ASN) Research, Development & Acquisition (RD&A) organizations will ensure that DON data and analytics requirements are reflected in their policies and in their oversight of the DON's acquisition programs. ASN RD&A will participate in the DON DAC (references (l), (q), (v)).

8.4 ASN (M&RA)

8.4.1 The ASN Manpower and Reserve Affairs (M&RA) organization leads the DON's efforts to cultivate a data-savvy civilian workforce and will participate in the DON DAC (reference (w)).

8.5 Mission Area Leads (MALs)

8.5.1 The Mission Area Leads (MALs) are responsible to include data and analytics optimization considerations when performing their policy and program oversight functions. Reference (j) lists the MALs and provides further detail on their responsibilities. The MALs will participate in the DON DAC.

8.6 DUSN (M) Strategy and Innovation Office

8.6.1 The Deputy Undersecretary of the Navy for Management (DUSN (M)) Strategy and Innovation Office is the lead for the Naval Innovation Network (NIN) and will participate in the DON DAC.

8.7 Functional Area Managers (FAMs)

8.7.1 The DON's designated IT portfolio managers are the Functional Area Managers (FAMs), who are responsible for managing applications, analytics, and data assets within their respective function-aligned domains. The FAMs are identified, and their responsibilities detailed in reference (i). FAMs will participate in the DON DAC.

8.8 Data Consumer Communities (DON Secretariat, OPNAV, HQMC, and Subordinate Commands)

8.8.1 The DON's data consumer communities will be segmented based upon the Department's organizational hierarchy. At the highest level (Echelon I), this will include the Secretariat, OPNAV, and HQMC. Subordinate commands are also subordinate data communities. The data communities are responsible to document the data strategies supporting their mission requirements.

8.9 System Commands (SYSCOMs)

8.9.1 SYSCOMs, as the technical authorities for their respective technical competencies, are responsible to manage DON system compliance with specifications, standards, architecture, and policy, including their data standards and interoperability. The SYSCOMs will participate in the DON DAC.

8.10 Program Management Offices (PMOs) and System Owners

8.10.1 The PMOs and system owners are responsible for management of system acquisition, including system-level physical data management.

9 APPENDIX D – REFERENCES

- (a) DoDI 8320.02, “Sharing Data, Information, and Information Technology (IT) Services in the Department of Defense,” 5 August 2013
- (b) DoDI 8320.07, “Implementing the Sharing of Data, Information, and Information Technology) Services in the Department of Defense,” 3 August 2015
- (c) UNSECNAV Memorandum, “DON FOIA, Privacy, and Civil Liberties Programs,” 14 May 2012
- (d) SECNAVINST 5211.5E, “Department of the Navy (DON) Privacy Program,” 28 December 2005
- (e) DoD Chief Information Officer Memorandum, “Adoption of the National Information Exchange Model within the Department of Defense,” 28 March 2013
- (f) SECNAVINST 5210.8E, “Department of the Navy Records Management Program,” 17 December 2015
- (g) DoD Chief Information Officer Memorandum, “Department of Defense Information Enterprise Architecture 2.0,” 10 August 2012
- (h) DoDD 8000.01, “Management of Department of Defense Information Enterprise (DoD IE),” 17 March 2016
- (i) SECNAVINST 5000.36A, “Department of the Navy Information Technology Applications and Data Management,” 19 December 2005
- (j) SECNAVINST 5230.14, “Information Technology Portfolio Management Implementation,” 9 November 2009
- (k) DON CIO Memorandum, “Release of Department of the Navy Enterprise Architecture Governance and Configuration Management Plans,” 15 September 2010
- (l) SECNAVINST 5000.2E, “Department of the Navy Implementation and Operation of the Defense Acquisition System and the Joint Capabilities Integration and Development System,” 1 September 2011
- (m) Marine Corp Order 5231.3, “Marine Corps Data Strategy,” 7 April 2009
- (n) SECNAVINST 5239.3c, “Cybersecurity,” 2 May 2016
- (o) DoD Chief Information Officer Memorandum, “DoD Net-Centric Data Strategy,” 9 March 2003
- (p) DON CIO Memorandum, “Department of the Navy Knowledge Management Strategy,” 7 March 2014
- (q) DoDI 8330.01, “Interoperability of Information Technology (IT), Including National Security Systems (NSS),” 21 May 2014
- (r) DoD Chief Information Officer Memorandum, “Department of Defense Net-Centric Services Strategy,” 4 May 2007
- (s) “Department of Defense Strategy for Operations in the Information Environment,” June 2016
- (t) Chief of Naval Operations, “A Design for maintaining Maritime Superiority,” January 2016
- (u) DoDI 5000.72, “Business Systems Requirements and Acquisition,” 2 February 2017
- (v) DoDI 5000.02, “Operation of the Defense Acquisition System,” 7 January 2015
- (w) SECNAV OCHR, “Creating the Data Savvy Workforce,” 1 December 2016
- (x) DoDI 8320.03, “Unique Identification (UID) Standards for DoD Net-Centric operations,” 4 November 2015

- (y) SECNAVINST 5430.7R, "Assignment of Responsibilities and Authorities in the Office of the Secretary of the Navy," 3 January 2017
- (z) United States Fleet Forces, "Fleet Design," 8 January 2017