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A PATH TO ACHIEVING ROBUST READINESS ASSESSMENT AND OPTIMIZATION CAPABILITY

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THE CHALLENGE: CURRENT DATA, SYSTEMS, AND MODELS UNDERMINE READINESS ASSESSMENT AND OPTIMIZATION

The Department of Defense (DoD) spends $350 billion a year tending to the readiness of its military forces for current and future operations.[1] This cost includes recruiting, retaining, educating, and training personnel; maintaining equipment; and provisioning food, fuel and other material to support operations. Yet, despite this substantial annual investment, there is widespread agreement that the U.S. military today is operating in a degraded state of readiness. Seventeen years of continuous conflict in Afghanistan and Iraq, coupled with seven years of budget uncertainty and severe funding caps imposed by the 2011 Budget Control Act, have wrought substantial wear and tear across the military enterprise.

These pressures have manifest in myriad ways, including reduced training; shortages in pilots and other specialized skillsets; depleted inventories; maintenance gaps; increased cannibalization of resources; high rates of personnel unable to deploy for medical or other reasons; lagging mission-capable rates; short dwell times for high-demand units; deteriorating installations and family support services; and preventable mishaps. "Our competitive edge has eroded in every domain of warfare: air, land, sea, space and cyberspace. And it is continuing to erode," according Defense Secretary James Mattis.[2]

This is occurring even as the global security landscape grows more dangerous, volatile, and complex. The potentially destabilizing impacts of terrorist organizations, climate change, mass migrations, cyber threats, and availability of emerging commercial technologies used as instruments of asymmetric warfare are vastly expanding the spectrum of scenarios in which the military must be prepared to operate.

Consequently, Defense Department leaders have made the task of rebuilding military readiness their top priority. "In this competitive environment, the Department must pay much more attention to future readiness, and regaining our Joint Force conventional overmatch over time," Mattis declared.[3] Army Chief of Staff Gen. Mark Milley put it more succinctly in a recent directive: "Readiness is #1 and there is no other #1."[4]

Fundamental to building and maintaining readiness is the ability to fully and accurately assess readiness, both at the unit and joint force levels. Clear-eyed readiness appraisals are critical when making decisions concerning deployments, contingency plans, training, maintenance, personnel, and procurements and the funding required to support those decisions. When data misrepresent the true state of readiness, then treasure, lives, and, ultimately, national security are put at risk. The need for accuracy applies not only when assessing current states of readiness, but also when projecting how today's investments will impact readiness in six months or two years.

Yet, many commanders lack high confidence in the readiness support systems they are supposed to rely on to make critical decisions. As Gen. Milley observed, "Accurate reporting is the first requirement to generating such readiness. Recently, units have reported readiness levels that indicate an ability to deploy rapidly, fight, and win decisively against a near-peer enemy capable of employing conventional and irregular capabilities. However, over the past 14 years, we have neither had the training opportunities nor gained the strategic depth to conduct decisive

unified land operations against a contemporary hybrid threat."[5]

As a result of this doubt, readiness measures reported by DoD support systems are frequently adjusted or overruled. Data are inconsistently detailed; some units resort to elaborate work-arounds to narrow perceived gaps between actual and reported readiness. Concerns with readiness reporting extend to the data, the systems that collect and process that data, and the readiness models used to decide which and how data is considered.

Data

Readiness-related data that commanders and planners consult is often subpar because it is incomplete, erroneous, redundant, irrelevant, inconsistently reported, out of date, or lacks meaningful context. Existing datasets that could enhance the readiness picture often are not accessible to readiness support systems for various reasons. An example of this is cost data for equipment and other resources; this data resides within DoD acquisition and logistics systems but typically is not incorporated into readiness support systems so that commanders are better informed to make investment trade-off decisions within a readiness context.

Systems

The Defense Department relies on a wide array of interconnected systems that collect and assess readiness-related data on thousands of units and portray that data to commanders and planners at every echelon. But these systems are limited in their ability to aggregate data across organizations into accurate, standardized, objective, high-level assessments because unit-level commanders apply different reporting practices and methodologies and have great leeway in assessing their own units' mission readiness. Moreover, these systems typically provide only point-in-time snapshots of resource readiness and therefore provide limited capability to diagnostically assess overall unit readiness or to help determine investments. Finally, these systems have limited, if any, predictive analytics capabilities with which to forecast readiness.

Models

Readiness models today – focused primarily on inventory sufficiency – often fail to predict with much accuracy how ready a unit is to accomplish a task or mission. They are helpful in determining whether a unit can deploy, but not necessarily whether it can win. To do that, planners often must create customized work-arounds, involving heavily manual processes, to piece together more realistic calculations of readiness. And because these presentations are customized, they are not easily aggregated at higher levels to create a wider view.

Part of the problem is a lack of understanding how the data are interrelated and how their interaction determines output over time. As one defense analyst put it: "Current readiness metrics focus on the inputs, such as flying hours, steaming days, tank miles, and training events. The military and Congress naturally focus on readiness inputs because they can monitor and control these directly through the budget. Readiness inputs are used as a proxy measure for the output - the ability of forces to perform the missions assigned to them. But an implicit assumption in this approach is that changes in the inputs will result in corresponding changes in the outputs. Moreover, it assumes that the target levels of inputs set by the military are optimal to achieve the types and levels of readiness required by defense strategy. When thinking about how the

military can most efficiently and effectively achieve readiness, the first step is to reexamine how readiness is measured."[6]

A number of defense experts have argued for a more dynamic approach to measuring readiness. Some have called for employing randomized experiments and continuous feedback loops to test and refine existing readiness models and causal relationships between inputs and outputs. Laura Junor, director of the Center for Strategic Research at National Defense University and former principal deputy undersecretary of Defense for personnel and readiness, has argued for the need to closely monitor both direct and indirect factors that contribute to readiness, as well as the gaps existing between the pipelines that supply ready forces and those demanding those forces.[7] These and other recommendations point to the need to adopt readiness models that are more complex and dynamic, but readiness support systems today lack the needed agility to support such models.

The effect of these shortfalls in the data, systems, and models that support readiness management is that defense planners and commanders are making critical budget, spending, and deployment decisions based on a readiness picture that is skewed and incomplete at best and inaccurate at worst. As Harrison concludes in his report on the challenges confronting current readiness approaches:

The current DoD method for resourcing readiness starts with the wrong metrics, lacks experimental data to isolate causal effects, and does not have a continuous feedback loop to update and refine readiness theories and models. Without these important steps in the process, the DoD is operating with significant blind spots when it resources readiness. The military could be significantly overfunding or underfunding readiness without knowing it. Worse still, it cannot reliably predict how changes in resources will affect readiness.[8]

When it comes to managing readiness within the Defense Department today, most activity is focused on reporting - as opposed to critically assessing and optimizing – readiness. We should strive for the opposite: Far more time and attention should be given to assessing and optimizing readiness. The question is: How can resources be allocated most effectively to achieve the readiness required by strategy?

OUR PERSPECTIVE: A TWO-STEP PATH TO IMPROVED READINESS ASSESSMENT AND OPTIMIZATION

"The end state is an enduring process that allows the Army to clearly analyze and evaluate its progress and provides the decision analysis capability to optimize resources and unit activity to minimize risk to the Army's mission." - U.S. Army Chief of Staff Gen. Mark Milley[9]

With these words, Gen. Milley outlined a key objective in moving the Army to a new paradigm in force generation called the Sustainable Readiness Process. Developing robust analytical capability to assess and optimize readiness is necessary for all planners and commanders across the Defense Department. Today's uncertain operational and budget environments point to a clear need for readiness support systems to be far more capable of collecting, aggregating, analyzing, and modeling data to provide more accurate and actionable insights for decision-makers. But the challenge of optimizing readiness is complex and will not be solved with a new dashboard – it requires a composite solution.

We propose a two-pronged strategy. First, address the immediate deficiencies affecting readiness data and systems that will help refine and correct the

"We propose a two-pronged strategy. First, address the immediate deficiencies affecting readiness data and systems that will help refine and correct the existing readiness picture...so planners can assess and analyze, not just report on, their readiness. Second, simultaneously build a robust data analytics modeling capability that can help optimize readiness... enabling commanders to spot "early warning" indicators; plot more accurate forecasts; make better informed investment and resource allocation decisions; and adapt more easily to more dynamic and complex situations."

existing readiness picture and advance current capability so planners can assess and analyze, not just report on, their readiness. Second, simultaneously build a robust data analytics modeling capability that can help optimize readiness. Such a capability should enable commanders and decision-makers to assemble a more comprehensive readiness picture; peer deeper into readiness pipelines to spot "early warning" indicators; plot more accurate forecasts; make better informed investment and resource allocation decisions; and adapt more easily to more dynamic and complex situations.

Address immediate deficiencies in readiness data and support systems

Readiness data collected across the Defense Department lack two pieces of critical context that hamper the task of objectively assessing and optimizing readiness: 1) a resource's impact on readiness, and 2) its associated cost.

Readiness systems today make little, if any, distinction between resources – such as trucks, ships, spare parts, bullets, or trained personnel – and their contribution to readiness. In most cases, readiness systems treat similar resources as equal – for example, one tactical radio is considered equal to all other tactical radios – regardless of their specific capabilities and contributions to accomplishing a task or mission. Also, readiness systems typically conflate the percentage of resource availability at a given unit with that's unit's degree of readiness. For example, a unit that has 70 percent of a given resource needed to accomplish a mission-essential task is routinely characterized as being 70 percent ready to accomplish that task. In reality, however, depending on the particular resource and task, having 70 percent of a needed inventory may reduce readiness for a given unit to zero. Or, conversely, it may have a negligible impact on readiness. Sizing up readiness in this way produces a highly skewed and unreliable view of readiness and puts the burden of assessment on the unit commander and his or her staff. Put another way, readiness reporting systems merely *contribute* to a readiness assessment as opposed to *reflect* the assessment. As a result, readiness reports generated by support systems are routinely overruled, revised, or simply bypassed in favor of "off-the-books" approaches by unit commanders. This leads to highly subjective readiness assessments.

To address this challenge, we propose infusing current readiness support systems with additional contextual data that recognizes the true impact of individual resources upon a unit's readiness for a particular task. This can be done with a weighted hierarchy of resources that accounts for each resource's contribution to readiness. Applying such a weighting methodology to the data enables readiness systems to account for the fact that one radio is more important than another radio for a particular mission or task, or that having less than 70 percent of a given resource available is a red flag for one mission but not for another. Having this valuable context associated with readiness data helps commanders more easily identify their biggest readiness degraders.

Likewise, cost is a critical piece of the readiness picture. Without knowing the underlying cost of a resource, planners are blind to the true cost drivers of their readiness. Associating a military resource with both its impact on readiness and its cost is critical to helping planners answer the all-important question of where to spend their next dollar. This insight not only helps navigate unit commanders and planners to the best readiness investment decisions, it arms them better when it comes to justifying and defending their budgets. To accomplish this, we propose integrating resource cost information, which readily exists in other

existing databases, into current readiness reporting systems, as previously suggested by defense budget expert R. Derek Trunkey of the Congressional Budget Office:

It has been difficult – if not impossible – to track how funding levels in those accounts affect SORTS [Status of Resources and Training System] scores, either in general or for specific units. DRRS [the Defense Readiness Reporting System] has the potential to establish stronger analytical relationships between funding levels and readiness, but that potential has yet to be realized. Additional changes to DRRS, such as adding linkages to budgetary accounts or creating new types of reports, could help establish those relationships.[10]

Resource cost and impact are just two of the more important pieces of additional data needed to improve the readiness picture for military planners. There are others – a wide array of data streams from DoD's existing manpower, training, procurement, inventory, and maintenance management systems can also be integrated into current readiness reporting systems to provide far greater insights into both current and future readiness. And these can assist not only with readiness investment and budget decisions, but also with contingency planning and deployment decisions.

Create a robust data analytics capability for readiness optimization

Better readiness data and systems are vital, but they are not sufficient to meet the needs of today's military planners. They also must be able to optimize readiness. This involves applying powerful analytical models to multi-varied readiness data in a way that points commanders and planners to better decisions concerning readiness investments, budgets, contingency plans, and the delicate balance between deployments today and sustained readiness for tomorrow.

To accomplish this, we propose employing a data platform built on open source software and open standards that can ingest, aggregate, and analyze large volumes of data of all velocities (such as batch and streaming data) and varieties (such as structured, semi-structured, and unstructured). Such a platform, which we call the Open Data Platform, functions as an expansive "data lake" – essentially a storage repository holding vast amounts of raw data in their native formats until they are needed. By assigning each data element a unique identifier and metadata tags, data of any variety can be quickly and easily queried, processed, analyzed, aggregated, and presented. The top benefits of the Open Data Platform are:

Better insights – Because the platform can ingest, store and analyze data of any format or type, including unstructured data, it is capable of generating far more insights. By collating varied data sets, planners can identify relationships between data and apply those insights to their models for more accurate forecasting.

Increased security – Security policies can be applied down to the individual data cell level and they can be changed as needed. This means that every cell of data is access-controlled to ensure people, regardless of their classification or role, have access only to the data they are authorized to view.

Data provenance – The Open Data Platform carefully tracks and preserves the lineage of all data so users know precisely from where and when data was sourced.

"Plug and play" within existing environments – Open source software and open standards enable the platform to readily integrate with components and systems already in place and with components that are best-suited for a particular deployment.

Extensibility – A modular, open architecture design enables the platform to expand in scale and capability as needed. This means the platform can easily adapt to new readiness models by integrating new data sources and applying new analytical methods.

This two-pronged approach will go far to address the data, systems, and model shortcomings that hamper readiness management today. With these steps, a fuller, more accurate readiness picture can be assembled by aggregating all relevant data sources, and the data itself can be enhanced with critical contextual information to deliver more refined insights. Readiness support systems can progress beyond presenting a unit's readiness to deploy – by ingesting more varied data, they can establish causal relationships between readiness inputs and outputs and assess a unit's readiness to accomplish its missions and scale that capability across the joint-service enterprise. With advanced analytics, planners can evolve their readiness models to assess battlefield capabilities, not just resources, and see deeper into readiness pipelines to spot "early warning" indicators faster.

PROPOSED APPROACH: MIGRATING TO A ROBUST READINESS ASSESSMENT AND OPTIMIZATION CAPABILITY

The exact path for enhancing an organization's readiness management capabilities will vary considerably, depending on its missions, resource portfolio, and the robustness of its existing readiness environment. Migrating multiple readiness systems to a common enterprise-wide approach used to be a complex process that involved significant software modifications – and considerable time and money. After years of building these capabilities separately, over several generations of projects for government agencies, we've developed an approach that automates much of the process – and takes into account the full range of enterprise considerations that impact success. These include anticipating future data needs, supporting business processes, building relationships between data owners and consumers, writing data requirements into new contracts, accrediting platforms and locking down security, and enacting internal policies governing data collection, storage, and access.

This enterprise approach requires domain experts - who bring deep understanding of an organization's mission and broad expertise in cultural and operational issues – to partner with a unified team of engineers and consultants who understand how to build open systems and get them online. Together, they enact a sequential, four-phased process that moves as quickly from up-front analysis to building the scale/capacity to support statistical analyses and visualization of existing data sets.

Phase 1: Prove the Concept

The process begins by setting up a sandbox, where the team can use public and client data sets to experiment with a variety of custom applications. They identify the unique use cases each organization seeks to develop and work to understand their challenges and limitations. Then, they provide a test platform in a standby environment to demonstrate how the system works while documenting the potential cost savings and/or efficiencies. For example, in a recent pilot, Booz Allen applied advanced analytics to multiple acquisition data sets to demonstrate how to reduce license costs and increase visibility across all functions of the enterprise.

Phase 2: Create the Hosting Environment

Next, the team creates an environment to host the data. For the Open Data Platform, the deployment scripts are automated using Infrastructure as Code

practices and tooling (Ansible) which provision the host environments in either Amazon Web Services (AWS) or Microsoft Azure, while ensuring repeatability of configuration and security controls. Data storage requirements are informed by use case scenarios, and the platform leverages the elasticity of the cloud infrastructure to dynamically scale as needed. Automation achieved through Infrastructure as Code practices, and contemporary container technology, expedites creation of the environment and deployment of the components.

Phase 3: Build the Platform

Organizations often have many data sets that reside in different silos and in different formats. To take full advantage of emerging analytics, ODP uses a central, cloud-based data platform that can easily ingest and integrate components together. As disparate data sets migrate onto the platform, each data element is identified with a metadata tag so authorized users can search for the data and access elements from a number of different starting points. To accelerate the platform development process, ODP uses an automated installation system that allows developers to provision a new data platform from a single command line. Because the platform uses open source products, it's easy to customize it for specific end use objectives simply by turning individual features on and off. As such, platforms can be built to support specific analytic functions like machine learning, predictive analytics, and even the next horizon of big data architecture.

Phase 4: Overlay the Data Science Toolkit

With the data platform in place, the process moves quickly to enable advanced data analytics using a complementary portfolio of algorithmic tools, which may include semantic processing, network analysis, stochastic and Bayesian modeling, pattern recognition, visualization, language translation, artificial intelligence, and machine learning.

This toolkit – and the entire data platform that supports it – empowers organizations to find patterns and connections that they didn't even know existed and provide faster and better answers to the increasingly complex readiness questions that commanders ask. For example, to support maintenance on a new aircraft platform, Booz Allen stood up a new platform and applied predictive analytics to establish correlations between specific environmental factors and unscheduled maintenance problems. The Air Force can now better predict what will happen at what rate, and order parts and schedule maintenance accordingly to decrease down time for its aircraft.

BOOZ ALLEN HAMILTON: YOUR ESSENTIAL PARTNER IN READINESS ASSESSMENT AND OPTIMIZATION

Booz Allen Hamilton is uniquely positioned to bring the required skill sets and expertise together to assist defense and intelligence clients in standing up robust readiness assessment and optimization capabilities. Our deep understanding of military missions, data analytics, and open systems architecture enables us to create the most advanced readiness assessment and optimization solutions for our DoD/Intelligence clients. Our strength lies in our unusual combination of strong technical engineering expertise coupled with deep mission understanding – so we not only know how to architect a powerful data analytics environment, we also know the value of the data to the mission.

NOTES

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3. *Secretary of Defense Jim Mattis, Testimony before the Senate Armed Services Committee, June 13, 2017,* https://www.armed-services.senate.gov/imo/media/doc/Mattis_06-13-17.pdf
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