For the Secretary of Defense

Implications of Technology on the Future Workforce

DBB FY17-04

Recommendations on the impact of automated technologies on the Department of Defense

PREFACE

This study, *Implications of Technology on the Future Workforce*, is a product of the Defense Business Board (DBB). Recommendations by the DBB contained within are offered only as advice to the Department of Defense (DoD) and do not represent DoD policy.

The Secretary of Defense established the DBB in 2002 to provide the Secretary and Deputy Secretary of Defense with independent advice and recommendations on how best business practices from the private sector's corporate management perspective might be applied to the overall management of DoD. The DBB's members, appointed by the Secretary of Defense, are corporate leaders and managers with demonstrated executive-level management and governance expertise. They possess a proven record of sound judgment in leading or governing large, complex organizations and are experienced in creating reliable solutions to complex management issues guided by proven best business practices.

Authorized by the Federal Advisory Committee Act of 1972, the Government in the Sunshine Act of 1976, and other appropriate federal regulations, the DBB is a federal advisory committee whose members volunteer their time to examine issues and develop recommendations and effective solutions aimed at improving DoD.

TASK

In October 2016, the Deputy Secretary of Defense directed the DBB to form a task group to study and develop recommendations that examine how the private sector is using or planning to use automated systems in business functions similar to those performed within DoD. This came on the heels of two parallel efforts. The two previous efforts were the Defense Science Board (DSB) "Summer Study on Autonomy" and the Defense Innovation Board (DIB) recommendations on innovation within DoD.

In June 2016, the DSB released its "Summer Study on Autonomy." The study focused on three areas: institutional and enterprise strategies to widen the use of autonomy, approaches to strengthening the operational pull for autonomous systems, and an approach to accelerate the advancement of the technology for autonomy applications and capabilities. The DSB concluded that "action is needed in all three areas to build trust and enable the most effective use of autonomy for the defense of the Nation," and that "DoD must take immediate action to accelerate its exploitation of autonomy while also preparing to counter autonomy employed by adversaries." Its focus was predominantly on autonomy within warfighting domains.

In early 2017, the Defense Innovation Board (DIB) put forth its own set of recommendations addressing innovation writ large within DoD. Its focus addressed issues involving data collection, sharing and analysis, and the cultures, competencies, barriers, and vulnerabilities related to keeping DoD on the cutting edge in technology, culture, operations, and processes. The DIB's recommendations were grounded in leveraging the advantages resident in artificial intelligence (AI) and machine learning (ML) to ensure DoD transforms to meet the challenges posed by current and future adversaries.

The DBB task group's efforts are uniquely focused, as it examined how the private sector uses automation for business functions that are similar to those performed within the DoD. The group assessed the potential risks and benefits of using current and future technology to support DoD's non-warfighting workforce. It then recommended courses of action for DoD to take advantage of recognized trends and show automation's potential impact on DoD's future workforce. The Terms of Reference for the study are at **TAB A**.

The DoD faces an extraordinary confluence of challenges, including a geopolitical environment arguably more strategically complex than that of the Cold War with multiple peer competitors, politically and militarily confrontational third world states, and a variety of ideologically motivated non-state actors. In addition to these challenges, the Department faces mounting, unsustainable costs and persistent budgetary uncertainty. In light of these conditions, the task group viewed this as an opportune time for DoD's leadership to gain an understanding of how best to pursue automated technologies to ensure DoD maintains its strategic competitive advantage.

The Honorable Jerry Hultin, former Under Secretary of the Navy, served as task group Chair. Other task group members included Cynthia Trudell, Atul Vashistha, and Taylor Glover. Captain Garrett Campbell, U.S. Navy, and Captain Thomas Koch, U.S. Marine Corps, served as military service representatives.

PROCESS

The task group reviewed relevant literature and interviewed more than 45 private sector and DoD senior officials for this study. Specifically, the task group compiled and compared automation best practices from government and the private sector, reviewed applicable laws and regulations, as well as DoD strategic documents, reports, and other pertinent data. It also reviewed studies from academic institutions, think tanks, businesses, and other government agencies. The task group investigated trends associated with three broad technology categories - Robotic Process Automation (RPA), AI/ML, and blockchain.[1] These efforts were intended to better understand how these technologies might provide DoD more accurate and faster decision-making, improved pattern and trend analysis, and opportunities for cost savings.

The full DBB membership received a briefing on the task group's findings and draft recommendations. The DBB voted to approve all recommendations after deliberation at the August 2, 2017 public meeting. **TAB B** is the briefing presented during the public meeting and approved by the Board. **TAB C** contains public comments received. **TAB D** reflects any DoD component comments or

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1 A 'blockchain' is a public ledger of all Bitcoin transactions that have ever been executed. It is constantly growing as 'completed' blocks are added to it with a new set of recordings. The blocks are added to the blockchain in a linear, chronological order. Each node (computer connected to the Bitcoin network using a client that performs the task of validating and relaying transactions) gets a copy of the blockchain, which gets downloaded automatically upon joining the Bitcoin network. The blockchain has complete information about the addresses and their balances right from the genesis block to the most recently completed block.

feedback received. **TAB E** includes appendices containing supporting information the task group considered relevant and took into account while formulating its recommendations. **TAB F** lists documents promulgated by Congress, the President, the Office of Management and Budget (OMB), and the Secretary of Defense mandating a reduction in the federal workforce size and pursuit of methods to streamline DoD business processes. Finally, **TAB G** and **TAB H** contain proposed pilot initiatives and demonstrations provided to the task group by the Defense Logistics Agency (DLA) and the Office of the Deputy Under Secretary of the Navy for Management (DUSN(M)).
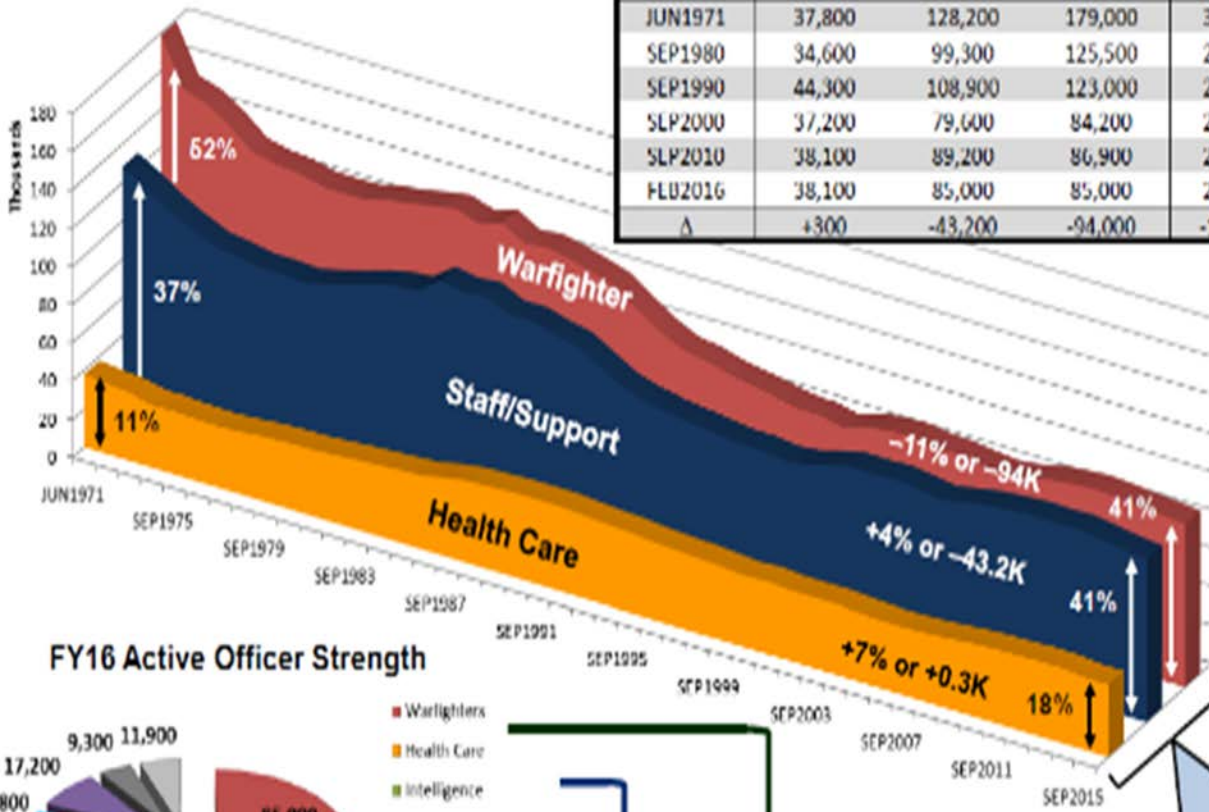
BACKGROUND

The DoD is at an intersection of several specific and interrelated trends that are shaping its view of the world. These trends are both internal and external to DoD and are occurring both domestically and globally. Challenges with personnel numbers, costs, and the ability to recruit the force of the future are evident and a steady decrease in the ratio of warfighters to support personnel over the past two decades has changed the composition of the force.

The percentage of personnel dedicated to support functions (for example, healthcare) has significantly exceeded the percentage of those considered warfighters. Figure 1 illustrates this trend among active duty Officers. Since Officers represent a relatively small subset of the overall active duty population, one can reasonably infer that when taking into account enlisted, the civilian workforce, and contractors, the percentage dedicated to support functions is even greater. For the purpose of this study, the assumption is that the DoD's business operations are generally associated with the support category.
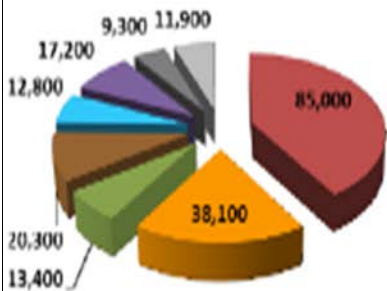
Increasing costs of personnel compensation and benefits compound the problem of the inversion of support personnel to warfighters (Figures 2 and 3). For example, in FY17 the Army doubled enlistment bonuses of up to $40,000 for recruits signing up for hard-to-fill military support specialties like cyber and military intelligence. The Army increased the bonuses, along with additional funding for advertising, to fill their annual recruiting mission.

Figure 1: DoD Active Officer Strength Trends by Inventory (Source: Active Duty Strength by DoD Occupational Code FY1971-FY2016, Defense Manpower Data Center)

Personnel Costs Per Active Duty U.S. Service Member, 1998-2014
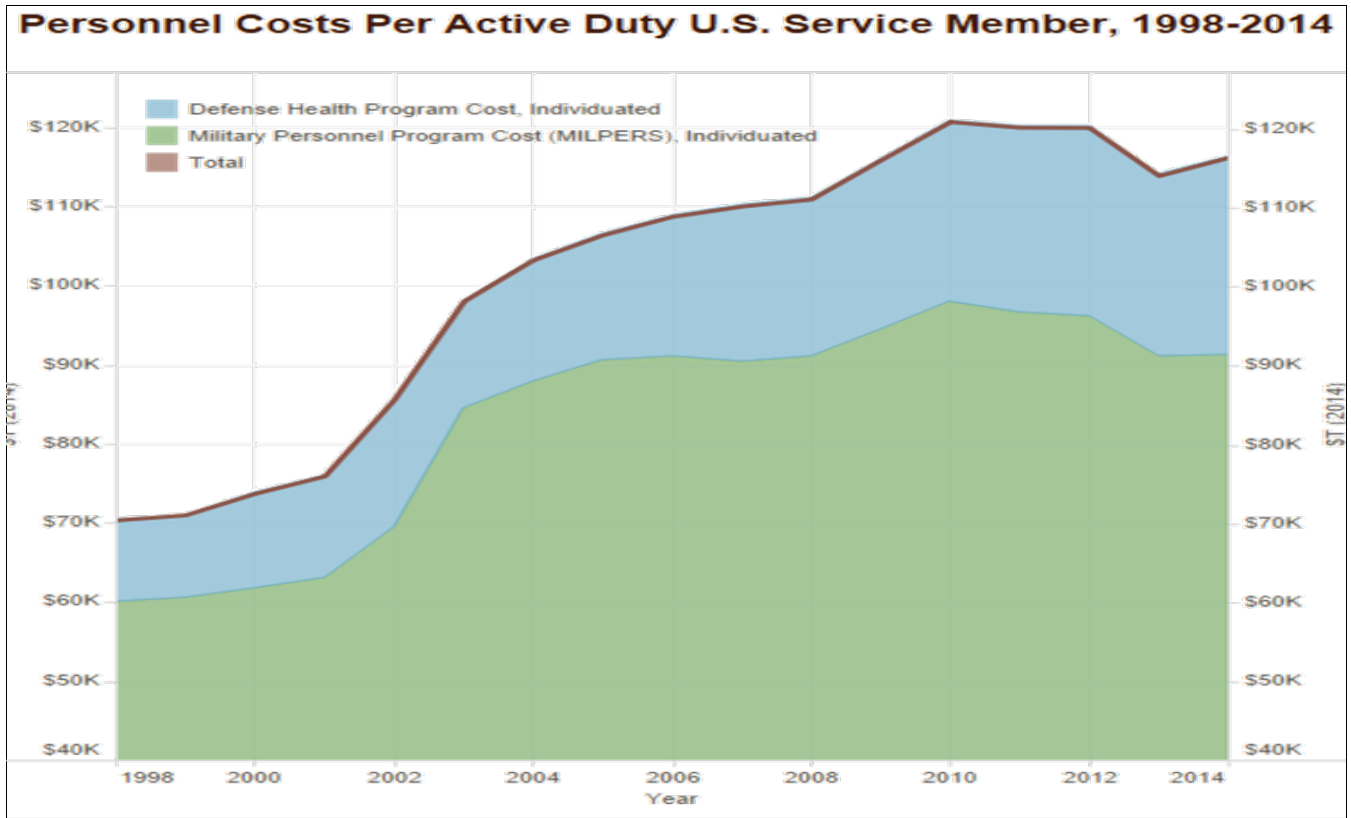
Figure 2: Personnel Costs Per Active Duty U.S. Service Members, 1998-2014 (Source: *Defense in Depth,* **Council on Foreign Relations, 1/28/2015)**

Total Military Compensation Funding in FY15 Federal Budget: $441B

(includes total discretionary and mandatory funding and lost revenue from tax expenditures)

Figure 3: Total Military Compensation Funding in FY-15 Federal Budget (Source: *Keeping Faith with the Troops: How Congress Can Fix the Military's Compensation Problems***, Forbes, 2/3/2015)**

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The cost to recruit the force (Figure 4) will likely continue to increase due to both the demand for technologically skilled and educated recruits, and the shrinking pool of candidates from which DoD is able to recruit (Figure 5).
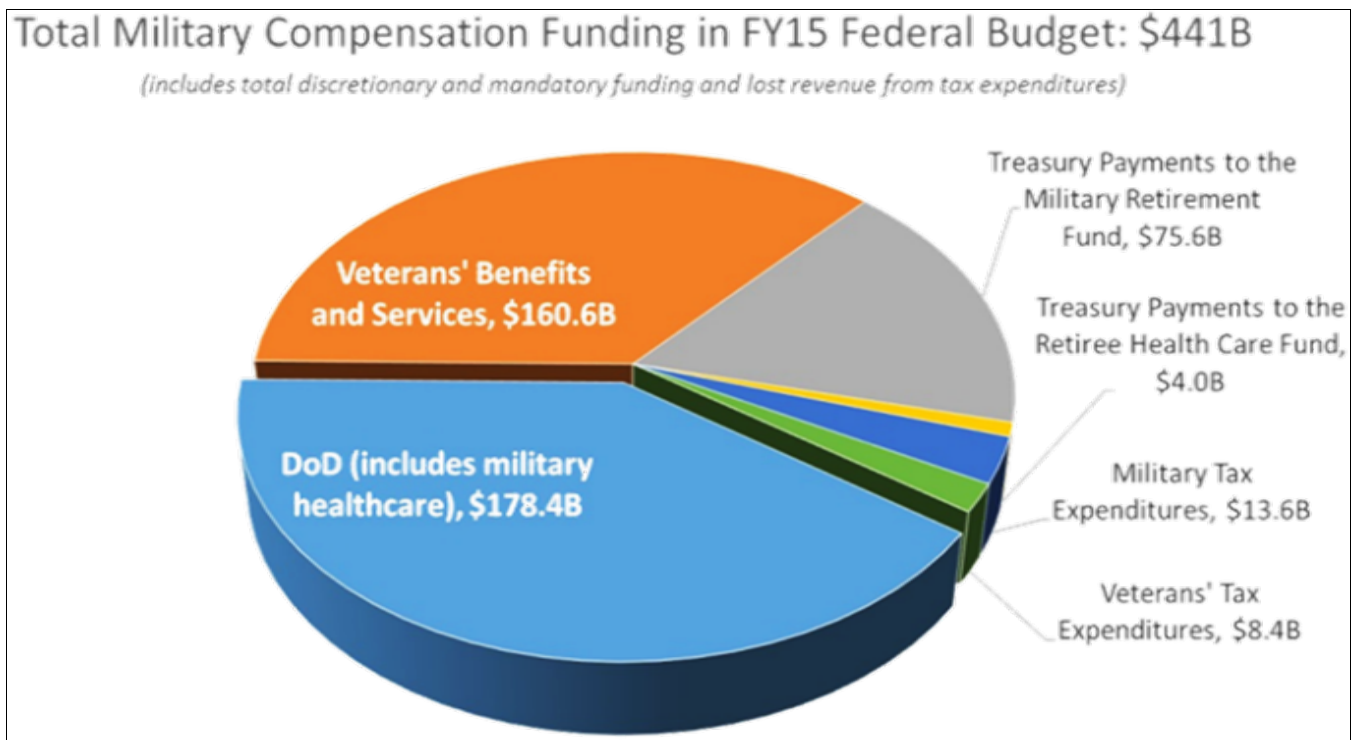
Seventy-one percent of young Americans today are ineligible for military service because they are unable to meet physical, moral, or other qualification standards. Further exacerbating this dilemma, DoD will continue to find itself in ever-increasing competition with industry to recruit and retain the highly skilled personnel required to field a technologically competent workforce.
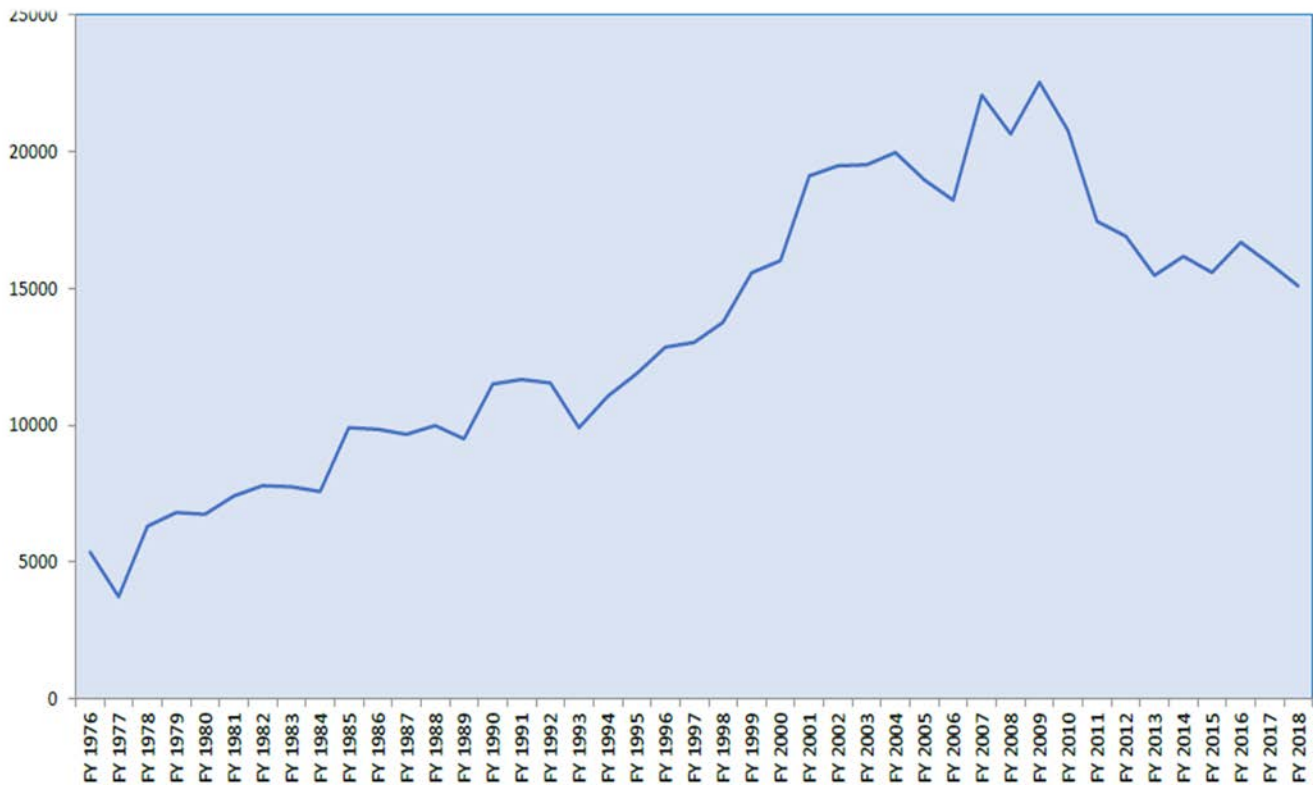
Figure 4: Cost Per Recruit 1976 – 2017 (Source: OUSD(P&R)/Military Personnel Policy)
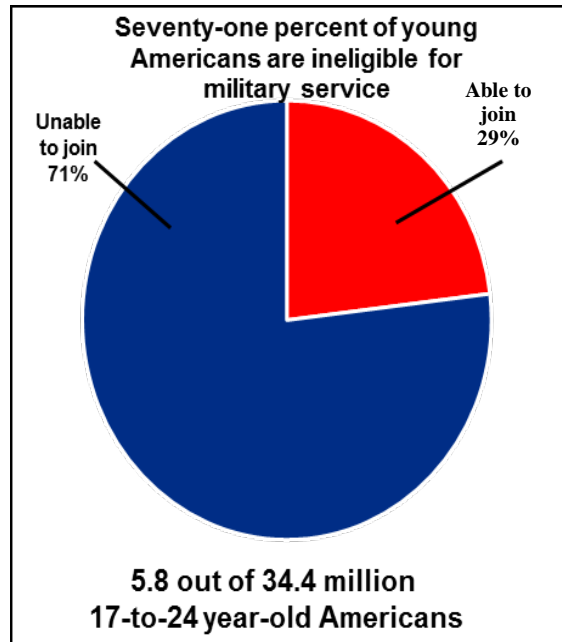
Figure 5: Shrinking Pool of Candidates (Source: *Ready, Willing, and Unable to Serve*, DoD Qualified Military Available Study 2013

In addition, DoD budgets have stagnated (Figure 6). There is little prospect of additional resources beyond those already allocated to stabilize the force. The Department, therefore, faces significant pressure to reduce and streamline it's spending to meet budgetary projections.

Billions of 2015 Dollars

Figure 6: DoD Budget Trends (Source: Congressional Budget Office)

Another trend is the on-going effort to reduce the size of the federal workforce. Congress, the President, OMB, and the Secretary of Defense have all published directives mandating executive agencies 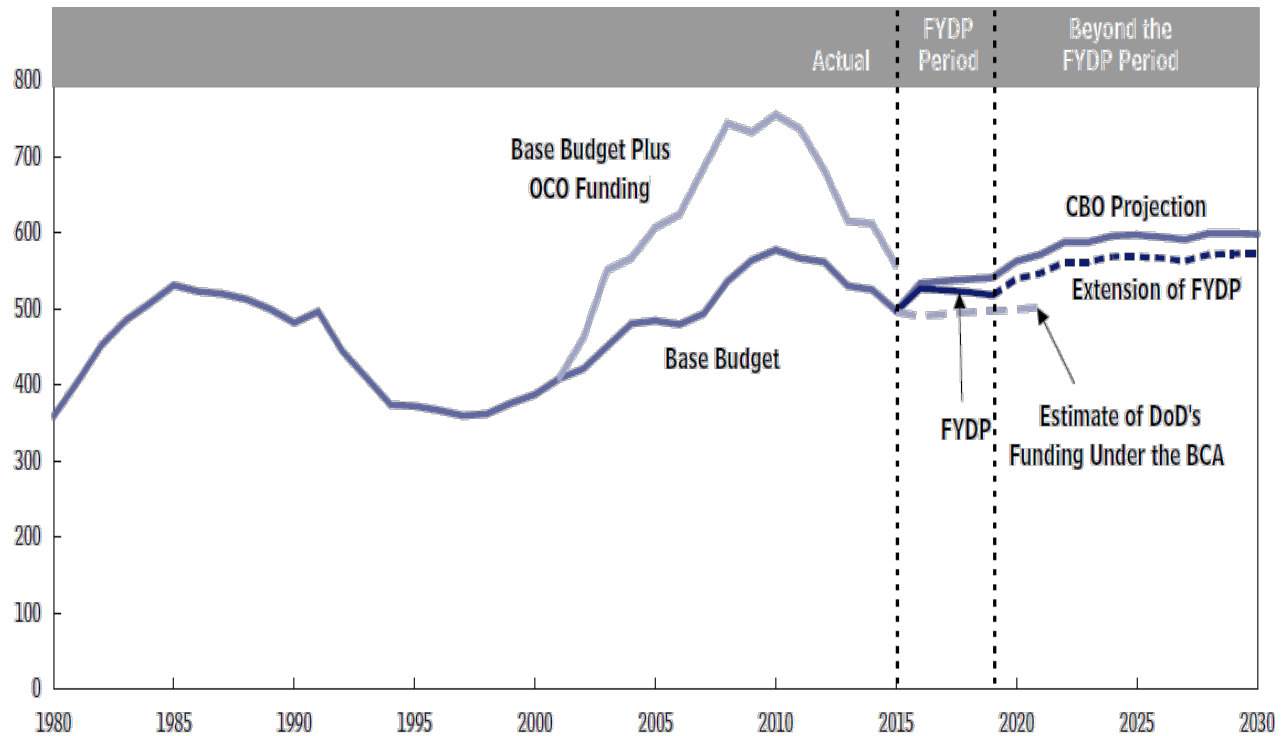find greater efficiencies in business functions with an eye toward reducing the number of federal employees. **TAB F** lists some of those documents directing these efforts.

Lastly, an internal trend affecting the Department is the pursuit of a technology-focused offset approach, dubbed by former Deputy Secretary of Defense Robert Work as the "Third Offset." This strategy is highly predicated on leveraging automated technologies. It envisions providing advanced technological warfighting advantages to offset advances in near-peer military capabilities. The Services' business functions and processes can use the same technology as it uses to automate its warfighting functions. Used in this capacity, it could enhance the quality of decision making and provide better, faster, and more accurate outcomes that, in turn, will translate into improved warfighting capability and capacity.

The Second Machine Age, or Fourth Industrial Revolution as it is being referred to, is a significant external trend that affects DoD. Transformative

technologies that reshape the way humans do their work and by how that work influences their view of the world characterize this period. Automation, robotics, and AI increase the ability of machines to perform more and more complex tasks.

Near-peer competitors are also using technology to enhance their capabilities. Competitors are challenging the US in areas and ways not experienced in over a quarter century. Some of this competition is overt, such as fielding technologically advanced weaponry and evolved tactics. Other aspects are less obvious. Competitors challenge the US in virtual spaces that require a new and omnipresent warfighting strategy.

Massive cost reductions in both computing power and data storage is another external trend resulting from technological advances. Global information technology (IT) accessibility is empowering the analysis of massive quantities of data, leading to an exponential increase in the quality, volume, and speed of decision-making at a decreasing cost to consumers.

An escalated competition for talent has emerged because of these technological advances in the private sector. The demand for people with niche skills is rapidly outstripping the supply coming out of colleges, universities, and technical schools from around the world. Realization of this trend has prompted a movement associated with talent management, as companies seek to maximize the potential of their employees or risk losing them, and thus their advantages over competitors. DoD will also have to remain competitive in this environment in order to recruit and retain the best and brightest of this talent; otherwise, it risks falling behind rising near-peer competitors.

The Opportunity of Automation

"Advances in robotics, artificial intelligence, and machine learning are ushering in a new age of automation, as machines match or outperform human performance in a range of work activities, including ones requiring cognitive capabilities."[2] The promise of automation in business processes is yielding significant benefits throughout the private sector regardless of the industry to which these technologies are applied. These benefits include: efficient data entry and generation of clean data for processes and analysis; the ability to analyze data to increase quality, volume, and speed of decisions; the reduction or reallocation of Full-Time-Employees (FTE) performing business functions; and

2 https://public.tableau.com/profile/mckinsey.analytics#!/vizhome/AutomationandUSjobs/Technicalpotentialforautomation

the ability to perform business transactions faster, more accurately, and at a higher volume. All of these benefits contribute to reduced costs, particularly labor costs, and to being able to reallocate resources, thus creating organizations that are more agile. The organizations are then able to dedicate additional resources and attention to continuous process improvement and innovation.

The private sector is reaping automation benefits now, and the ability to do so is accelerating. While results vary across the private sector, automation has shown the potential to accomplish up to 45% of the tasks currently performed by employees across all occupations. Through its application, 60% of all occupations are likely to have 30% or more of their work activities automated in the future. Companies have also been able to reduce costs by more than 30% through automation and executives now have the detailed information to make more key decisions both faster and with more accuracy.

Applying Automation to DoD

The Third Offset strategy focuses primarily on kinetic applications of automation, rather than on the Department's business operations. Pursuing these warfighting applications are truly important, but DoD is missing significant opportunities to apply these new technologies and novel approaches to the routine world of business functions. Business functions account for an estimated one-third of DoD's total budget. As such, it offers the biggest potential impact on our competitive advantage since the application of certain automation technologies to business operations could effectively address some of the trends described above.

Most organizations within DoD possess similar business processes to those in industry, for example, finance, human resources, and logistics. Correspondingly, the same benefits realized through automating business processes in the private sector should be achievable in DoD. The Department could more accurately track financial data, improve management effectiveness, and facilitate faster and more accurate analyses by applying automation to these areas. This would improve organizational decision-making, empower leaders to more efficiently solve complex problems, and would likely generate second and third order benefits as well. One such benefit that stands out is the potential for automation to free up resources (human and financial) which can then be shifted from business operations to applications that more directly support warfighting,

such as the Technology Offset Program called for in §218 of the National Defense Authorization Act for Fiscal Year 2016.

OBSERVATIONS AND FINDINGS FROM INDUSTRY

The Automation Continuum

It is important to define the basic terminology before highlighting the benefits automation brings to industry. Over the course of this study, the task group discovered that there is a definitive continuum, spanning the application of a variety of technologies, as depicted in the Robotics Capability Spectrum in Figure 7. Additionally, **TAB E - Appendix 1,** "Orientation to Autonomy" provides an overview of these technologies.
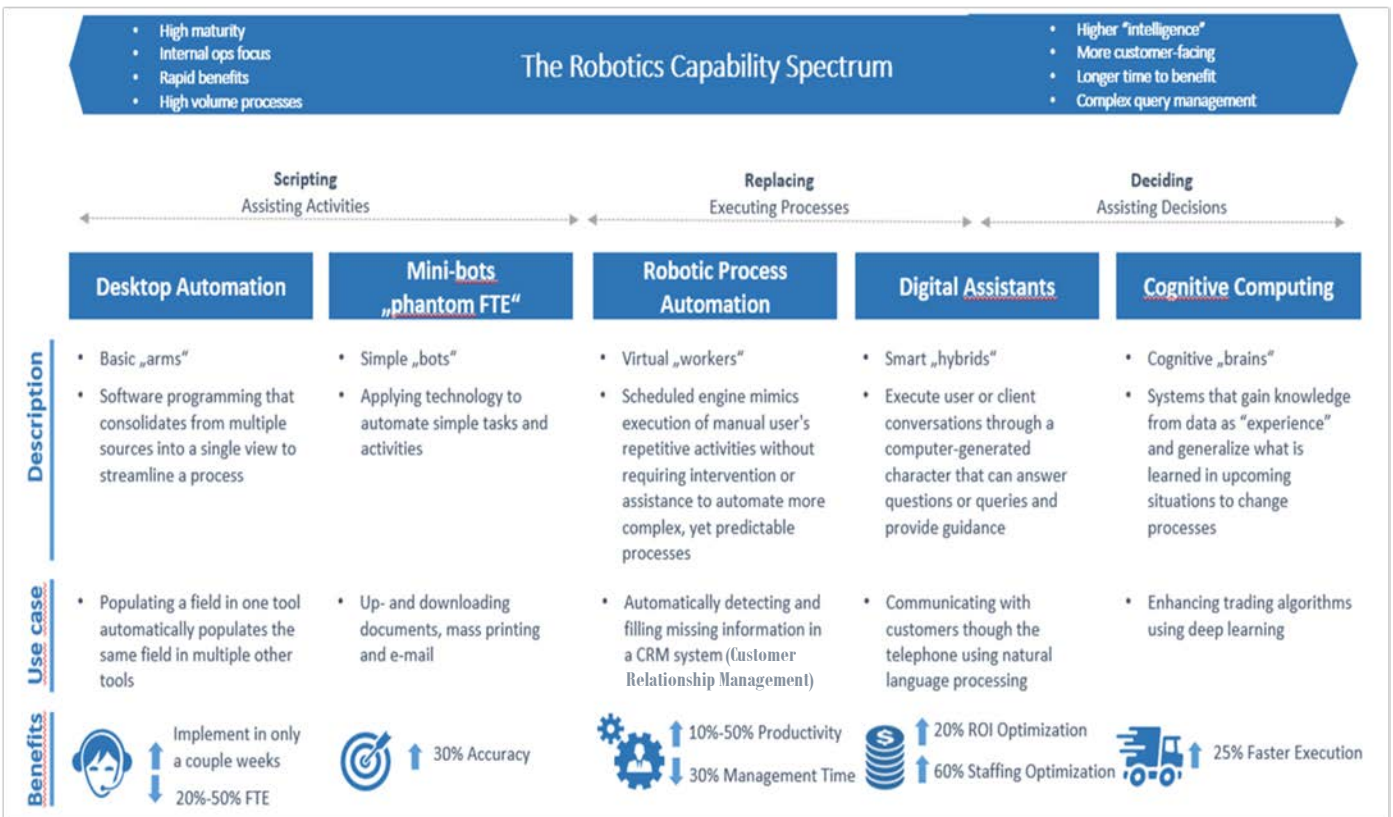

Figure 7: Robotics Capability Spectrum (Source: Accenture)

The majority of the task group's interviews with industry focused primarily on the private sector's application of replacing executing processes, specifically RPA; the center column in Figure 7. **TAB E - Appendix 2** provides additional information on outcomes achieved using RPA. However, it was evident that

companies pursuing, or having pursued, RPA were in turn better positioned to pursue AI and ML technologies.

Incorporating automation technology across the continuum is not necessarily a linear process. Rather, organizations will develop different types of automation depending on the application and the desired benefits. However, it is important to note that each technology category, depicted in the various columns in Figure 7, requires a different type of workforce to employ the technologies to achieve the desired benefits.

Automation Benefits in Industry

Data processing appears to be the biggest area in which the private sector is pursuing automation. Reducing the volume of paper forms and labor-hours dedicated to manually entering data can decrease processing errors and cycle times. Automating these processes can exponentially increase an organization's ability to process even larger volumes of data, which also improves analyses based on that data, and in turn, increases accuracy and speed of decision-making. Companies also found that automation of business processes directly translated to decreased labor and operating costs, increased employee productivity, and improved regulatory compliance. Furthermore, there is a direct correlation between automation of business processes and higher customer satisfaction levels.

Industry Examples

The task group found generally similar outcomes resulting from automation, regardless of industry. As depicted in Figure 8, most of these impacts are significant.

Metric	International Business Process and Tech Services provider	International Telecom	UK Energy Supplier
Processes automated	14	15	60
Automated transactions per month	120,000	400,000-500,000	~1m
Bots	27	160+	300+
FTE replacement	N/A	100+	600+
Cost savings	30%	ROI 650-800%	200%

- Data provided through interviews with Blue Prism

Figure 8: Industry Automation Metrics (Source: DBB study analysis)

These examples highlight specific metrics associated with automation efforts from the task group's interviews with other companies (Figure 9).

Fortune 50 Healthcare Company
- Cost savings: $200 million in a $3 billion space
- 1.7 million claims/day
- 92% via automated clearing house
- 75% solved via automation
- 25% manually adjudicated
- 4-8 months to see ROI from process reengineering & automation
- Invested in process engineers and data scientists for data analytics
- Significant reductions in time, claim fraud, waste and abuse, and increased volume of claims processed

International Tech Provider
- 50% reduction in operating costs
- $50 billion company with 75k employees
- Acquired 150 companies over a 15 year period
- 3000 workers doing transactional work – current focus for automation
- 40% cost reduction per transaction
- 50% cost savings gained through process reengineering & automation
- Reduction in personnel doing repetitive tasks - data entry
- Increased responsiveness – logistics

Multinational Consultancy
- Reduction in FTE's - 30% FTE's retained and reskilled – retraining programs
- BPO service provider - Automates back-office processes across healthcare, banks and financial organizations, telecom industry
- 20-40% processes are suitable for automation (task automation)
- 70% processes do not require reengineering
- 10-12 weeks to implement RPA for simple processes w/in back-office functions

Figure 9: Automation Success Cases within Various Sectors of Industry (Source: DBB study analysis)

The task group compiled these three cases through interviews with company leadership. A breakdown of each is as follows:

1. A Fortune 50 Healthcare Company

The healthcare company saved approximately $200 million out of $3 billion in typical costs by automating claims. The company performed nearly 1.7 million claims per day and automation allowed them to process 92% of claims via an automated clearinghouse. Of these, automated business processes solved 75% of the claims while 25% require manual adjudication. This allowed the company to reallocate its workforce toward solving just the 25% of claims not meeting clearinghouse criteria, reducing the number of FTEs required to process claims.

The healthcare company quickly realized financial benefits. Leadership noted a return on investment (ROI) in four to eight months. They also noted that applying automation successfully is dependent on correctly identifying the exact business processes with particular potential for process reengineering and automating. Having a workforce capable of providing this skillset required an investment in process engineers and data analytics experts. Reengineering the nature of the company's workforce and business processes produced positive second and third order effects. One positive effect was the ability to address fraud--the largest monetary losses incurred by healthcare companies. Through automation, significant reductions in the number of fraud claims and the time required to process each claim allowed the company to achieve significant additional savings. Finally, customer satisfaction increased because employees could process claims faster and a respond more quickly to the customers.

2. An International Tech Provider

This technology company is an international industry leader worth $50 billion, employing 75,000 workers. The tech provider had acquired 150 companies over a 15-year period. Chief among its challenges associated with mergers and acquisitions was standardizing data and gaining an understanding of what work the workforce was performing. The company found that standardizing business processes across its enterprise had significant benefits, reducing operating costs by 50%. The company also significantly reduced the number of FTEs who were doing transactional work. Automation reduced the cost per transaction by 40% and the overall costs by 50% when applied to the business processes associated with these transactions. The company indicated the cost savings were a result of a dedicated effort to reengineer processes and fully understand where to apply automation. This in turn led to a reduction in personnel performing repetitive tasks – such as data entry. As a second order effect, the company was also able to apply automation to inventory management. The company was able to

increase logistics responsiveness and thus improve customer service by gaining a more accurate account of assets across their enterprise.

3. A Multinational Tech Consultancy

This company, a multinational technology-consulting group, automated business processes across a spectrum of healthcare companies, banks and financial organizations, and telecom companies. On aggregate, the consultancy found that these companies experienced a reduction in FTEs. The company was able to reallocate and reassign thirty percent of the FTEs affected by automating business processes. They noted there are costs associated with this process, but throughout industry, regardless of sector, successful automation efforts all included establishing an employee-retraining program. Successful efforts included identifying which employees were best suited and adaptable to the new work environment and which employees were best suited to perform the required new work. Furthermore, retraining programs supported creating a culture dedicated to both employee welfare and to continuous process improvement.

This tech consultancy company stated that, across the spectrum of industries, approximately 20-40% of all business processes are suitable for automation. The company stressed that management should not view automation as a panacea, nor should companies apply it to every process. Roughly, 70% of business processes did not require reengineering within the companies they had supported. The company stated that the key to success was identifying those specific processes that would become more efficient through automation. Determining ahead of time which processes would benefit from automation (and which would not), was the key determinant of success. On average, automation projects took 10 to12 weeks to implement, and involved application of RPA for simple processes within the various business functions. Benefits realized by automating business processes included: 1) an increased volume of work; 2) refocused the workforce to higher-level tasks; and 3) an increased task work speed.

What the Case Studies Reveal

These three case studies clearly demonstrate the potential benefits of automating business processes. Each company achieved different benefits based on its unique motivation and application of automation, but each experienced significant returns on the investment.

The task group conducted further study on the impact of automation within pharmacies. In doing so, the task group found that DoD maintains hundreds of pharmacies among military medical centers that range from large treatment facilities the size of major urban hospitals down to small local clinics. With this in mind, the task group researched the application of automation within outpatient pharmacy services and in-patient pharmacy services (Figure 10).

Unlike the companies interviewed from other industries, the primary objective for automation in both of these pharmacy cases was safety. However, the pharmacies also realized cost savings and process improvements as a secondary benefit. Improvements included increased product output and a decreased FTE workload due to automating many of the mundane and repetitive tasks pharmacists previously performed. Many of those pharmacists were then re-assigned to higher-level tasks associated with patient care and management. This resulted in a major shift in the nature of work being performed, but did not result in a major reduction in the number of FTEs required.

Robotic Pharmacy Service Provider	University Medical Center Automated Pharmacy
Automated pharmacy – customer focused pharmaceutical dispersing and management to optimize retail and ambulatory services	Automated pharmacy – university medical center focused on the preparation and tracking of medications with the goal of improving patient safety.
– Automation ROI upwards of 900% with incorporation of inventory management systems and Chronic Care Systems*	– Same # of FTE's - 2X or greater work output
– Provide a 50-60% decrease in FTE workload	– Reduction in FTE workload resulted in shift of FTE's to other duties (focus expertise on direct patient care and interaction)
– 99.5% system reliability rate	
– 99.7% accuracy rate	– 0 errors per 350,000 doses of medication prepared
– 150 to 225 prescriptions/hr (machine dependent)	– Increased volume, decreased time of distribution
– Average cost is $400-$800K/unit	– 2-3 yrs to break-even/capture costs (did not conduct process analysis and process reengineering upfront) - "Requires change leadership" – resulted in delayed ROI - 5-6 years for full ROI
* ScriptPro indicated DoD has 700+ automated pharmacies, but does not purchase these services	

Figure 10: Automation within Pharmacies (Source: DBB study analysis)

It is also important to note that in both pharmacy cases, returns on investments took longer to achieve relative to the cases the task group examined from other industries. However, this is likely because the pharmacies' motivation for automating was to improve accuracy and safety, rather than to increase output or decrease costs, although pharmacies also realized those benefits as a second-order effect.

Impacts of Automation

Automation's impact to the private sector fall into two categories: those that affect the organization and those that affect the employees (Figure 11).

On the Organization	On the Employee
Companies see increase in speed, accuracy, and volume; reduction of errors; increases in safety, elevated levels of customer satisfaction and budgetary savings	Reduction and/or elimination of dull, routine, repetitive tasks
CEOs can manage organization more effectively	Elimination of reworking completed tasks to fix errors in a process
COOs can streamline and rationalize work, maximizing efficiency	Refocus of time and effort on higher level cognitive tasks requiring soft skills like creativity, judgment, empathy, and emotion
CFOs can more easily audit the organization	Higher job satisfaction
CIOs can gain a bridging solution between modernization and recapitalization of large IT systems	If task is transactional and rules-based, then FTE workload can be reduced

Figure 11: Automation's Impact (Source: DBB study analysis)

Many analysts have recently predicted that automation is likely to displace individual employees, bringing the potential for tremendous disruption in labor markets. On the contrary, the evidence actually suggests that in aggregate, organizations, their senior leadership, and their employees will likely all experience positive and transformative benefits because of automation.

A Roadmap for Success

Roughly, two-thirds of private sector automation attempts encounter significant setbacks or end in failure. With that in mind, the companies interviewed by the task group followed a general roadmap to success. This

roadmap guided both the proper application of technology and helped foster a culture of continuous process analysis and adjustment as required to realize benefits. A fundamental first step was to identify opportunities that are ripe for automation. This involves matching the right tool (automation) to the right problem and the desired business end state. Not every process needs automating. Mistakenly going forward with this mindset led many in the private sector to expend resources on processes that did not yield any significant ROI. The best opportunities for applying RPA involve targeting those processes that are labor intensive, repetitive, and prone to human error.

Next, businesses must validate their processes if those processes are determined to be potential candidates for automation. This entails understanding the upstream and downstream impact when reengineering a business process. Employees must rationalize, understand, and reengineer the end-to-end business process so they can fully understand the effect automating will have on the business process.

The organization can select a design model and acquisition plan once they fully understand the business process. Interviews with private industry showed that companies tend to follow one of three models, depending on whether they possessed the workforce required to implement and sustain the changes. Some companies outsourced the work and services involving the competencies needed to transform and change the company. Others outsourced the workforce with a focus toward developing an organic capability ("outsource-to-insource"), while others undertook automation designs that could leverage their existing organic workforce. A common feature among all of the design models seems to be to stand up a "Center of Excellence" (CoE) within the company. The CoE's specific purpose was to build capacity for the automation change and to ensure alignment of efforts across the organization.

It is critical to establish a CoE focused on automating the business processes since the CoE acts as a node to oversee not only the above steps in the automation roadmap, but also to govern the plan itself. The CoE can ensure infrastructure exists to support business process automation. The CoE can insure both vertical and horizontal infrastructure layers are in place.

The next step in an automation roadmap is designing and executing demonstrations. Demonstrations can prove the benefits of automating the business processes to both leadership and the impacted employees. Private

sector interviews indicated that these demonstrations were typically aimed at showcasing the positive impacts on lower level business processes up and down stream. These demonstrations helped prepare the organization for the next steps in the business process.

Scaling and sustaining the transformation is necessary in order to understand the effects of the new automated business process and to replicate demonstrated positive impacts. The company can save and invest in any future projects they identify. This supports a continuous iteration of designs for further automation for a next generation of benefits.

To summarize, the typical roadmap described in interviews with private industry consisted of these steps: identify the right opportunity; validate and prepare it to be automated; identify and acquire the workforce needed to pursue automation; develop the plan; ensure adequate governance and infrastructure to support the automation; demonstrate positive impacts of automation; adjust the automation change to the proper scale; and once in place sustain the benefits and create a culture of continuous process improvement. While each company differed in its approach to these steps, task group interviews indicated common foundational elements that seem to represent common denominators among successful cases of business process automation.

Six Foundational Elements

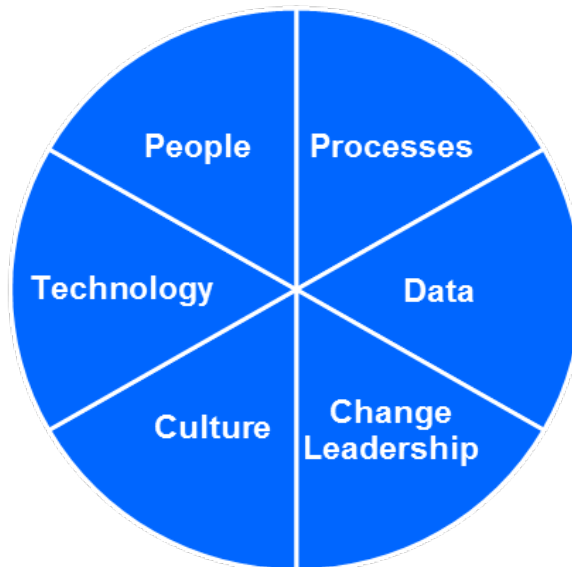The interrelated elements that underpin private industry's success are:

Figure 12: Six Interrelated Foundational Elements (Source: DBB study analysis)

1. **Change leadership** – Dedicated ownership and governance of automating business processes is essential to success. Successful cases involved top-down leadership fostering bottom-up empowerment and the creation of a culture of continuous process improvement. A change leader was the single most important element associated with success in all cases.

2. **Processes** – Business process analysis and reengineering is essential. It requires organizations to focus on the problem, not the solution. Unsuccessful cases seemed to pursue the application of technology without a clear or defined problem to solve. There is a direct relationship between improper identification within a process and maintaining bad processes, such as collecting bad or faulty data, inefficient use of IT, and under-utilization of people.

3. **Data** – Successfully applying business process automation can establish a single source of ground truth through data; to achieve this, companies require skilled employees, cultural transparency, and dedicated leaders who actively pursue the leveraging of data and understand its value.

4. **Culture** – Creating an agile and innovative culture dedicated to continuous process improvement requires leadership, recognizing and applying the right professional skillsets, and an emphasis on accuracy in business processes. Developing a culture dedicated to problem solving and continuous process improvement requires talented people supported through established professional career paths.

5. **Technology** – IT solutions are readily available. The task group found no shortage of companies willing to offer IT solutions based on automation. The right IT to support efficient and effective business processes is undoubtedly important, but process analysis and subsequent reengineering defines what technology best meets the organization's needs. Therefore, process analysis and reengineering when necessary is essential.

6. **People** – Successful automation efforts require an understanding of what people are doing within processes. The task group found this to be an absolute prerequisite for successfully applying RPA in pursuit of increased efficiency and accuracy. Automation requires a balanced professionalized workforce that possesses the necessary skills to analyze, implement, and leverage its benefits.

These six foundational elements were noticeably present in all cases the task group examined. Notably, when a company pursued automation and encountered difficulty, there was typically a corresponding absence of at least one of these elements in some form or another. The single most important factor routinely was the impact of people; that of the employee, no matter the level of leadership, on the automation process.

Impact of Automation on Employment

There is a significant body of work forecasting how automation will impact humans and jobs. Figure 13 provides a snapshot of different opinions on these impacts and prospects for current and future employment. The task group found the various forecasts to be insightful, but they may not be universally applicable to DoD since the near-term ability to automate business process on a large scale is questionable. For additional information, **TAB E - Appendix 3** addresses the issue of automation and its application as it pertains to jobs.

OECD	McKinsey Global Institute	Deloitte Center for Government Insights	International Federation of Robotics	University of Oxford
http://www.oecd-ilibrary.org/social-issues-migration-health/	http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works	https://dupress.deloitte.com/dup-us-en/focus/cognitive-technologies/artificial-intelligence-government.html	https://ifr.org/img/office/IFR_The_Impact_of_Robots_on_Employment.pdf	http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf
"…On average, across the 21 OECD countries, 9% of jobs are automatable."	"…Less than 5% of all occupations can be automated entirely… ~60% of all occupations have at least 30% of constituent activities that could be automated."	Potential of between 96.7 million and 1.2 billion federal government hours annually saved.	"Robots substitute labor activities but do not replace jobs. Less than 10% of jobs are fully automatable."	"…47% of total US employment is in "high risk" category [for automation]…"
"…Automation and digitalization are unlikely to destroy large numbers of jobs. However, low qualified workers are likely to bear the brunt of the adjustment costs…"	"The right level of detail…to analyze the potential impact of automation is that of individual activities rather than entire occupations. Every occupation includes multiple types of activity, each [having] different requirements for automation."	"In the near term…large government job losses are unlikely. But cognitive technologies will change the nature of many jobs…freeing up to one quarter of many workers' time to focus on other activities."	"Automation has led overall to an increase in labor demand and positive impact on wages….The issue is how to enable middle-income earners in the lower-income range to upskill or retrain."	"…[Reduction in] aggregate demand for labor input in tasks that can be routinized by means of pattern recognition, while increasing the demand for labor performing tasks that are not susceptible to computerization."

Figure 13: Opinions on the Impact of Automation (Sources: as indicated)

OBSERVATIONS AND FINDINGS FROM WITHIN DOD

Throughout the task group's research, it became resoundingly clear that DoD business processes are very similar to those of the private sector,

highlighting the potential benefits to be gained from enterprise-wide automation. A more in-depth analysis of how the six interrelated foundational elements common to private sector success can apply to DoD is included in **TAB E - Appendix 5**. Significant opportunities exist within DoD to improve the quality of decision-making and reduce costs through automation, though to date, little has been published on automating DoD business processes. The Department seems to lack an enterprise-wide understanding or appreciation of potential benefits offered by automating business functions despite a myriad of legislative and internal directives calling for increased efficiency within DoD, coupled with a recent focus on automation in warfighting. There appears to be minimal ongoing efforts to automate business functions within DoD.

Throughout its research, the task group was unable to find any internal DoD analysis seeking to determine which specific tasks DoD personnel are currently performing that might be performed better through business process automation. That realization was enlightening. As industry leaders pointed out, this is often the fundamental first step in successful automation initiatives.

Thus, Figure 14 represents the task group's effort to analyze automation potential among DoD business-related occupations. Taking a set of occupations within the Army, Navy, and Air Force, the task group used the Department of Labor's Occupational Network (O*NET) On-line[3] to determine their Standard Occupational Classification. It then correlated them with data from a 2016 McKinsey Global Institute (MGI) study to identify each's automation potential.[4]

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3 https://www.onetonline.org/
4 http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works
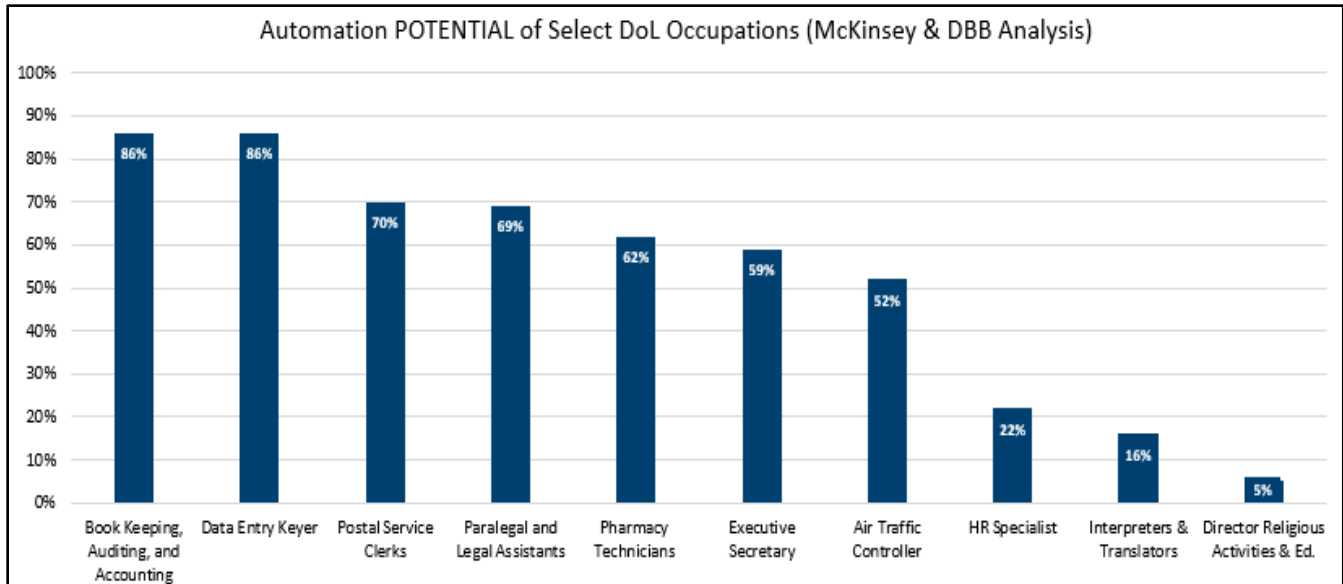
Figure 14: DBB Comparison of DoD Occupations (Sources: McKinsey Global Institute's *"A Future That Works"* Methodology and Department of Labor Data)

A full description of how the task group members preformed this analysis is in **TAB E - Appendix 4**.

The MGI study concluded (and the task group agrees) that virtually no occupation is likely to be fully automatable any time in the near future, but there are many tasks within a wide range of occupations that could be automated immediately using currently available technology. As such, many Army Military Occupational Specialties, Navy ratings and associated Navy Enlisted Classifications, and Air Force Specialty Codes related to business functions are particularly prime candidates for automation. Automating many of the tasks within these occupations could significantly reduce the number of support personnel needed to perform them, thereby reducing the labor costs associated with those business functions.

DoD Data

The task group noted that it is unlikely automation efforts within any organization will prove successful without a robust understanding of the tasks that FTEs are performing. This was a common point of view in interactions with senior leaders across the spectrum of private sector companies. The interviewees also conveyed that automation attempts without such data incur unplanned costs and delays.

As mentioned above, there is currently insufficient data on DoD's business processes and associated workforce statistics to determine which current FTE tasks can be automated. The mandate and guidance to determine this information exists. The regulations governing DoD Business Enterprise Architecture (BEA) Level 4 analysis, which addresses manual versus automated transactions, delineates that the Services are responsible for Level 4 analysis. However, enterprise-wide enforcement of BEA Level 4 compliance is inconsistent. The task group found there is currently little incentive to conduct Level 4 analysis, which could identify areas prime for automation although the Chief Management Officer (CMO) is undertaking efforts to bolster application and enforcement. Therefore, the data required to make informed changes does not generally exist across the enterprise. DoD is currently unable to effectively evaluate and predict the potential for, or impact of, automating certain jobs because very little data exists on what work people actually do. The Department is unable to accurately calculate or predict its personnel ROI. Consequently, it is hard to justify investment in automation technologies focused on business processes.

Interviews with various DoD agencies and the Services also highlighted deep cultural resistance to sharing data. The task group often heard that this cultural resistance is pervasive and results in a reinforcement of maintaining status quo, wherein access to data by owners, in a stove-piped fashion, is restricted. Developing higher-level automation, such as AI and ML, fundamentally requires open data and/or access to data. However, in DoD, opening up data to those outside the organization is often viewed as risky due to the potential for losing control of a desired narrative.

The task group observed that people were often concerned about the cyber security risk to aggregated data. Multiple DoD interviewees noted that every cyber intrusion, no matter the domain, is viewed as an existential threat to the organization. Within the acquisitions community, for example, program managers often prevent centralizing information in order mitigate the security risk, despite the fact that doing so hinders the use and benefit of that information to the enterprise writ-large. Such barriers further limit DoD's ability to apply automation at the enterprise level.

Finally, the task group observed a common refrain among various DoD leaders interviewed - that cloud-based technologies could alleviate enterprise-wide issues associated with accessing and applying data. It was abundantly clear

from industry interviews, however, that the end user still lacks a single source of ground truth for data without business process analysis and reengineering to streamline those processes. Cloud-based technologies will not alleviate any of the inaccuracies and inconsistencies currently surrounding DoD data without process analysis and reengineering.

DoD Culture and Talent

DoD culture understandably places a low priority on critically examining business functions since DoD is an operationally-focused enterprise that is engaged globally. Business functions are generally viewed as part of the overall support structure. The task group further observed a demotivating impact on the personnel who perform these business functions. Many of the people working in business functions had a perception that DoD does not prioritize business support functions, and that it was often viewed as an afterthought. Another common view suggested promoting efficiency among a business process could result in a reduction in an organization's headcount and/or budget, which in turn is viewed as a loss of power and status. With this in mind, the task group recognized it is no coincidence that DoD will rarely seek to confirm whether efficiencies forecasted in a program are actually achieved. These cultural perceptions are inimical to achieving efficiency/cost savings and further disincentives any investment in automation.

A root cause driving this cultural issue is that the DoD workforce seems to lack the talent required to initiate and scale automation, including business process engineers, software engineers, and computer and data scientists. Nor are there any existing mandates or incentives in place to recruit such a workforce, and even if there were the combination of adverse culture and limited incentives would likely deter the most motivated, technically skilled, and innovative of workers.

DoD Management and Governance

The task group further found that the DoD seems to lack effective business portfolio management across the enterprise. For example, the offices of the Under Secretary of Defense (USD) for Acquisition, Technology, and Logistics (AT&L), USD for Personnel and Readiness (P&R), USD Comptroller, DCMO, and DoD Chief Information Officer (CIO) each manage independent structures for business operations, despite many similarities across the different offices. This lack of consistent enterprise-wide business processes contributes to the

inadequate enforcement of standards laid out in the BEA. Additionally, each of the Services also maintains its own business processes. This situation results in minimal ability to drive business process improvement throughout the enterprise, including through automation.

The task group also found that DoD has governance constraints that limit its ability to implement new projects. These include:

1. <u>Congress</u>. Appropriations delays and uncertainty make planning and execution difficult. The multi-year budget process requires precise planning, which is especially difficult with rapidly evolving technology.

2. <u>Certification and Procurement Limitations</u>. The mandates of Defense Business System certification obstruct agility and generate inefficiencies.

3. <u>Regulations</u>. Federal and DoD acquisition rules restrict DoD's ability to collaborate with the private sector for business process innovation.

On a positive note, even when taking all the above into account, there are examples within DoD where organizations are moving forward in applying automation and reaping its benefits.

A DoD Success Case: Defense Logistics Agency (DLA)

The task group interviewed a collection of seven senior leaders from DLA. The findings were resoundingly positive and highlighted a successful example of the automation continuum being applied in DoD. This automation deployment has resulted in significant outcomes. Since September 11, 2001 DLA has maintained roughly the same number of FTEs, but increased its throughput during that time from $17 billion to $42 billion annually. This is significant because it mirrors the type of success industry has achieved through automation, and it demonstrates that similar outcomes can be achieved in other areas of DoD. Figure 15 provides percentages of automation achieved within DLA functions and processes.
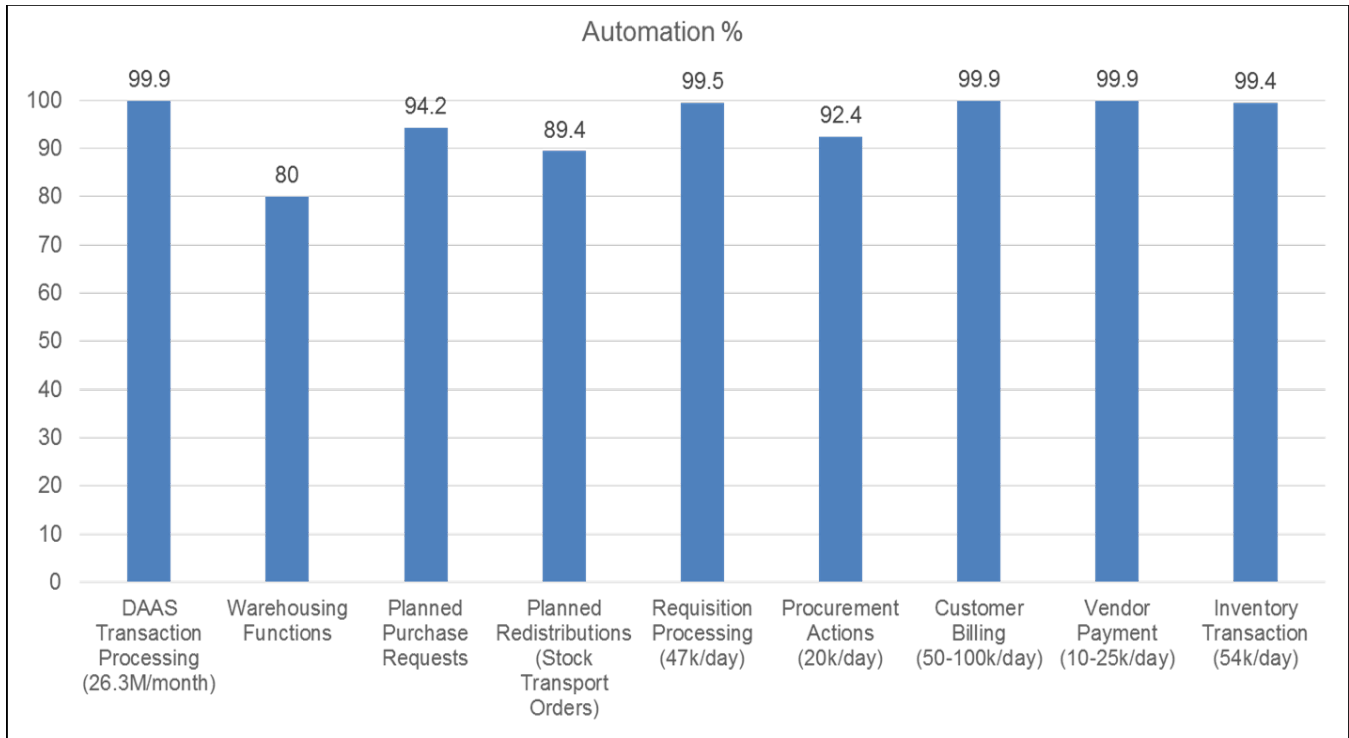
Figure 15: Automation Percentages (Source: Defense Logistics Agency)

In analyzing DLA's success, the task group identified similarities with private industry, which are key factors for the successful implementation of automation:

1. Leadership possessed a committed, progressive vision.

2. Leadership continuity, which facilitated effective management and governance, fostered devotion to the reforms, and enforced discipline within the organization.

3. Leadership encouraged employee engagement in order to promote a widespread understanding of ROI.

4. A continuous improvement mindset permeated and shaped the culture in the areas of reporting and data collection, analysis and insights, and advanced analytics.

DLA represented the most advanced and comprehensive case the task group found within DoD. Unsurprisingly, DLA possesses a leadership team with a clear vision of automation's intended benefits, dedicated to effective change management, and involved in its automation efforts.

Overall Findings on Automation within DoD

The task group believes there is significant opportunity to build upon existing efforts across the enterprise and recognize that successful business process automation is being achieved within DoD. The areas of finance, personnel, logistics, and acquisition are particularly prime candidates. Automating business processes within these areas has the potential to provide the following initial benefits:

1. Reduce personnel required to perform transactional administrative business processes.

2. Achieve more accurate financial and human resources tracking.

3. Realize more effective management through increased decision-making speed and accuracy on baseline business issues.

4. Attain more advanced data analytics for system monitoring and responsive problem solving.

5. Generate second and third order solutions not presently available.

6. Enhance cost transparency among defense suppliers in the acquisition process.

7. Improve talent management through:

   a. Fewer FTEs in the military, civilian, and contractor workforces assigned to manual transaction-processing,

   b. Curtailment of cost inversion ("tooth-to-tail ratio"),

   c. Robust talent development and meaningful civilian careers in order to more effectively compete for talent with the private sector.

RECOMMENDATIONS

The DBB offers the following recommendations for DoD to leverage the potential benefits inherent in automating business functions. **TAB E - Appendix 6** provides additional details on these recommendations.

1. Automation Strategy

The task group recommends the Secretary of Defense promulgate a strategic vision for business process automation and the attendant implications for the future workforce, with an emphasis on achieving the following:

– Increased quality, volume, and speed of business decision-making

– More efficient use of resources and more accurate information in support of warfighting

– Accelerating the Technology Offset Program by applying automation to business processes

– Reducing or reallocating personnel performing business processes in order to reduce labor costs

– Closing the gap between future workforce requirements and anticipated shortage of talent

The Department should also develop an enterprise strategy that prioritizes use of automation to significantly improve the quality and cost of business processes in conjunction with this strategic vision. This strategy should include the military services and the "Fourth Estate" actively leveraging accessible and readily applicable private sector experience to optimize defense business processes. It should also improve the quality of manpower data and develop metrics to measure automation ROI. This is critical to ensure that automation efforts and dollars are correctly applied. Lastly, in light of automation's frequent portrayal as a detriment to workers, any enterprise strategy must describe a redeployment plan for impacted employees.

2. Leadership Actions

The task group recommends that the Deputy Secretary of Defense mandate business process reviews to identify automation opportunities, both enterprise-wide and at the component levels.

The CMO should lead this initiative by setting and promulgating objectives, milestones, metrics, and timelines. All DoD business functions should be required to provide a plan as to where automation can be applied. Where appropriate, it should be integrated with other enterprise-wide functions. DLA has pilot programs, which might prove useful in generating initial thoughts for such an endeavor.

Automation will not be successful if it is solely a top-down initiative. Leadership should therefore empower mid- and lower-levels of management to lead and effect this change. Senior leaders should demand managers oversee automating business operations with as much focus as we manage the application of kinetic force within the warfighting domain.

Leadership must develop a strategic communication plan to emphasize the value of automating business functions to advance this effort. Such outreach could include Automation 101 briefings that educate senior and mid-level leadership on automation's benefits. The communication plan's goal should be to create a natural demand signal within all levels of leadership. Including references to business processes alongside kinetic applications in strategic communications about the Technology Offset Program would also facilitate a unity of effort within DoD's workforce.

3. Build Capability and Capacity

Within the private sector, a key to successful automation is establishing an internal organization dedicated to the effort's application and scalability. Similarly, the task group recommends the Secretary of Defense establish a Business Operations Center of Excellence (BOCoE) in order to apply the strategic emphasis needed to achieve the desired results through automation. A DoD BOCoE should:

– Establish and enable governance of automation efforts

– Provide guidance and support for demonstrations and trials to maximize success

– Partner with the private sector and academia to build talent capacity

– Share best practices and processes throughout DoD

– Ensure continuous process improvement – second and third generation automation opportunities

– Support and advise on technology, vendor oversight, and program management

Since an automation continuum requires fundamental transformation, it is essential to have partner organizations that support a BOCoE. The task group agreed with the DIB's recommendation that DoD establish an Autonomy University Affiliated Research Center (UARC). Such a UARC should focus on innovation, information, and best practices from the private sector, and it should address challenges and problems associated with maturing the automation continuum, as it presently exists.

4. Develop Automation Talent

There is no greater asset to DoD than its people, but in light of the external and internal trends outlined above, there is a need for DoD to not only change, but to act. Therefore, the task group recommends DoD assemble talented teams that can design and implement RPA and AI projects which address the business process analysis, reengineering, and automation required to move DoD forward. This requires recruiting a critical mass of leaders, managers, and technical support personnel who understand RPA, AI, and ML and who have the capability to lead and manage change.

The DoD should apply an 'Outsource' to 'Outsource to Insource' to 'Insource' model where best applicable to gradually build competency and transform DoD's workforce and culture. This includes supplementing these teams with talent from external partners as necessary. The Department must development a workforce whose skills are considered core to DoD's operations and success given the decisive nature of data and its role in 21st century warfare.

Developing this workforce requires that the Department define and build professional career paths for new critical skills and associated occupations. These include data scientists, computer scientists, process engineers, software designers, etc. Beginning this transformation will require DoD to actively partner with industry in order to expand corporate fellowships and other similar industry exchange programs to gain exposure to new skills and ways of thinking about organization, structure, operations, and innovation. Expanding or changing programs like the Secretary of Defense's Corporate Fellows programs is not enough. Investments in knowledge and application of business process automation are required. We recommend the Department carefully choose the personnel selected to acquire this knowledge and experience. DoD should also

mandate that upon completing these fellowships, personnel are subsequently employed in positions best suited to achieve the desired ROI, taking into account the individuals' specific skillsets and fellowship experience. This step is critical to achieving the desired benefits from the investments made. Historically, fellowship programs seem to miss the ROI opportunities these assignments might provide.

The task group also recommends applying Human System Integration (HSI) tenets to automating business processes. This includes focusing on and incorporating the impact of the human factor into designs. The Department should ensure HSI billets support the program and resource managers in understanding the productive benefits of designing at the interface between humans and machines. This will require DoD to cultivate a population of professionally educated HSI professionals.

5. Facilitate Adoption

Adopting automation is rife with pitfalls, and there are many cases of failure within both the private and public sector. The task group recommends the following methods to facilitate adopting automation:

A. Conduct high-profile demonstrations and competitions to increase awareness and develop world-class solutions. This should encourage new efforts toward innovation and reinforce the commitment to expanded development of new business processes and technologies. **TAB G** and **TAB H** are examples of pilot programs and/or demonstrations provided to the task group by DLA and DUSN(M).

B. Develop an RPA/AI readiness self-assessment tool so all business processes within DoD can be analyzed per the BEA. Use a credible benchmark when automating these business processes. Using RPA and AI experts to benchmark all of DoD, including its suppliers, could identity get-well programs. It could then use the results to generate internal change and reduce cultural resistance.

C. Leverage challenge communities (e.g. the National War College's MD5[5]) to solve business problems.

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5 Established in 2015 and based at Fort McNair in Washington, DC, MD5 is a novel public-private partnership between the National Defense University, New York University, and a network of national research universities that seeks to reinvigorate civil-military technology collaboration and value creation through the development of a National Security Innovation Corps – entrepreneurs and entrepreneurs solving high tech problems in the interest of national security.

DoD needs to develop and foster a problem-solving community, much like that of MD5 and organizations such as the Office of Personnel Management's Innovation Lab. Replicating these efforts would better enable DoD to leverage crowdsourcing forums to support continuous process improvement, including automation of business processes. DoD could incentivize employees through prize money competitions dedicated to solving business problems.

CONCLUSION: AUTOMATION PROVIDES A STRATEGIC ADVANTAGE

There is an inextricable link between automating business processes and automating warfighting. Automation is a true offset, in that it will revolutionize DoD's effectiveness and provide the United States a major competitive advantage in shaping global stability and warfare, especially with respect to peer-competitors and our current enemies.

Automation has the potential to be to business processes what stealth and precision were to warfighting—a once in a decade opportunity to dramatically reshape DoD business operations. Its application will enhance the quality of data and decision-making and will provide better, faster, and more accurate outcomes at lower costs. This will result in a more efficient use of resources and better support to warfighters. The substantial cost savings, primarily in the reduction of FTEs, will free up human and financial resources, which can be reapplied toward enhancing DoD's warfighting capability.

Equally as important, automation will have a positive impact on our greatest asset - DoD employees. Automation is likely to result in a more innovative and competitive workplace, and a more talented and productive workforce.

On behalf of the Defense Business Board, this study is respectfully submitted,

Jerry MacArthur Hultin
Task Group Chairman

Defense Business Board

TAB A

TERMS OF REFERENCE

APR 1 7 2017

MEMORANDUM FOR CHAIRMAN, DEFENSE BUSINESS BOARD

SUBJECT: Terms of Reference – Implications of Technology on the Future Workforce

Over the last few years, reductions in the Department's budget have adversely impacted readiness, force structure, and acquisition programs. As a result, the Department must work to continuously leverage advances in technology to reduce personnel, operations, and maintenance costs.

The private sector has made significant progress in the use of automated systems in an effort to reduce workforce staffing and its associated costs. In addition to performing physical and administrative repetitive tasks and streamlining processes, intelligent autonomous systems are moving toward performing higher functions, including assessing environmental conditions, cognitive analysis, and problem solving. At the same time, the cost of these systems has decreased. Many of these capabilities have potential applications to the Department and offer an opportunity to reduce force structure and costs associated with support functions.

To assist DoD in maximizing its resources, I am establishing a task group under the Defense Business Board ("the Board") to study and develop recommendations that:

- Examine how the private sector is utilizing or planning to utilize automated systems in the workplace for non-discretionary functions similar to those performed within the DoD;

- Assess the potential risks and benefits of utilizing this technology in support of DoD's non-warfighting workforces: civilian, uniformed, and contractor. Identify technologies within the private sector that have potential application to the DoD;

- Recommend courses of action and timelines for the Department to best take advantage of these trends; and

- Review such other matters as the DBB determines relevant.
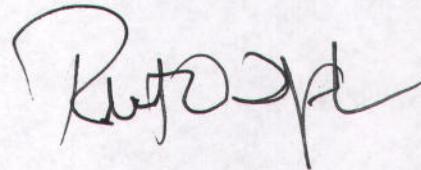
Task group recommendations will be presented to the DBB for thorough, open deliberation in a noticed public meeting in accordance with the Federal Advisory Committee Act and the Government Sunshine Act. The Board will provide its final findings and recommendations to the Secretary of Defense or the Deputy Secretary of Defense, no later than twelve months from the signing of these terms of reference.

OSD004233-17/CMD005974-17

In conducting its work, the DBB has my full support in all requests for data or information that may be relevant to its research or fact-finding under the terms of reference. As such, the office of Secretary of Defense and Component Heads are requested to fully cooperate and promptly facilitate requests by the DBB staff to access relevant personnel and information deemed necessary, as directed by paragraphs 5.1.8. and 5.3.4. of DoD Instruction 5105.04, "Department of Defense Federal Advisory Committee Management Program," and in conformance with applicable security requirements.

As a subcommittee of the DBB, this task group shall not work independently of the DBB's charter and shall only report its recommendations to the full DBB for public deliberation and majority approval, pursuant to the Federal Advisory Committee Act of 1972 as amended, the Government in the Sunshine Act of 1976 as amended, and other applicable federal statutes and regulations. The task group does not have the authority to make decisions on behalf of the DBB. The members of the task group and the DBB are subject to 18 U.S. Code §208, governing conflicts of interest.

Defense Business Board

TAB B

PUBLIC MEETING BRIEFING

PROVIDED TO THE DEFENSE BUSINESS BOARD

DEFENSE BUSINESS BOARD

Implications of Technology on the Future Workforce

August 2, 2017

HON. Jerry Hultin   Dr. Cynthia Trudell   Mr. Atul Vashistha   Mr. Taylor Glover

CAPT Garrett Campbell, USN Representative
Capt Thomas Koch, USMC Representative

These are the final briefing slides as approved by the Defense Business Board in the public meeting held August 2, 2017.

17-S-2249

Task Group Focus

Terms of Reference

"Over the last few years, reductions in the Department of Defense (DoD) budget have adversely impacted readiness, force structure, and acquisition programs. As a result, the Department must work to continuously leverage advances in technology to reduce personnel, operations, and maintenance costs.

The private sector has made significant progress in the use of automated systems. In addition to performing physical and administrative repetitive tasks and streamlining processes, intelligent autonomous systems are performing higher functions, including assessing environmental conditions, cognitive analysis, and problem solving. These capabilities have potential applications to the DoD and offer an opportunity to reduce force structure and costs associated with support functions."

- **The Task Group will:**
  - Examine how the private sector uses automation* for business functions that are similar to those performed within the DoD
  - Assess the potential benefits and risks of using this technology in support of DoD's non-warfighting workforces
  - Recommend courses of action for DoD to take advantage of recognized trends
  - Show automation's potential impact on the DoD future workforce

*For the purpose of this brief "automation" includes Robotic Process Automation (RPA), Machine Learning (ML), and Artificial Intelligence (AI)

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Forces Shaping the Future of Defense

- Internal Forces:
  - Increased number of personnel devoted to support functions over past two decades
  - Stagnated DoD Budgets
  - Mandates from Congress, OMB and DoD to reduce the size of the federal workforce
  - Implementation of a technology offset strategy requiring agility and seamless capability to deal with significant complexity

- External Forces:
  - Automation, robotics, and artificial intelligence have increased the capacity for machines to perform more and more complex tasks
  - This is causing:
    - Enhanced capability of peer and near-peer competitors for simultaneous physical and virtual warfare
    - Global IT accessibility through cost reductions of data storage and computing power
    - Escalated war for talent as a result of automation in the private sector

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Automation Provides Major Advantages

- Today, DoD is aggressively exploiting automation in the warfighting realm

- The private sector is reaping advantage now, and it is accelerating
  - Automation has the potential to accomplish up to 45% of the tasks performed by employees across all occupations
  - 60% of all occupations are likely to have 30% or more of their work activities automated
  - 30% and above reductions in costs have been achieved, plus major advances in speed, accuracy, and volume of decisions

- The Department can obtain similar advantages in it's business processes
  - Automation can enhance the effectiveness of DoD's business processes
  - Enhanced data quality and decision-making will provide better, faster, and more accurate outcomes at a lower cost, and will allow for better use of resources and enhanced support to the warfighter
  - Reduction in costs, primarily in FTEs and other operating expenses, will free up resources (human and financial) that can be transferred to the fight – important because, for now, warfighting remains manpower intensive
  - For DoD employees, using automated processes will result in a more innovative and competitive workplace and a more talented and productive workforce

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"Harnessing Automation for a Future that Works"
~Mckinsey Global Institute
http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works

"Switching Careers Doesn't Have to be Hard: Charting Jobs That Are Similar to Yours"
~New York Times
https://www.nytimes.com/2017/07/27/upshot/switching-careers-is-hard-it-doesnt-have-to-be.html

"China Plans to Use Artificial Intelligence to Gain Global Dominance by 2030"
~MIT Technology Review
https://www.technologyreview.com/s/608324/china plans to use artificial intelligence

"How AI and Machine Learning Can Drive Government"
~GCN
https://gcn.com/articles/2017/07/11/ai-machine-learning.aspx

"Building an AI Chip Saved Google from Building a Dozen New Data Centers"
~Wired
https://www.wired.com/2017/04/building-ai-chip-saved-google-building-dozen-new-data-centers/

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Potential of Automating Select DoD Occupations

Bar chart showing automation potential percentages:
- Book Keeping, Auditing, and Accounting: 86%
- Data Entry Keyer: 86%
- Postal Service Clerks: 70%
- Paralegal and Legal Assistants: 69%
- Pharmacy Technicians: 62%
- Executive Secretary: 59%
- Air Traffic Controller: 52%
- HR Specialist: 22%
- Interpreters & Translators: 16%
- Director Religious Activities & Ed.: 5%
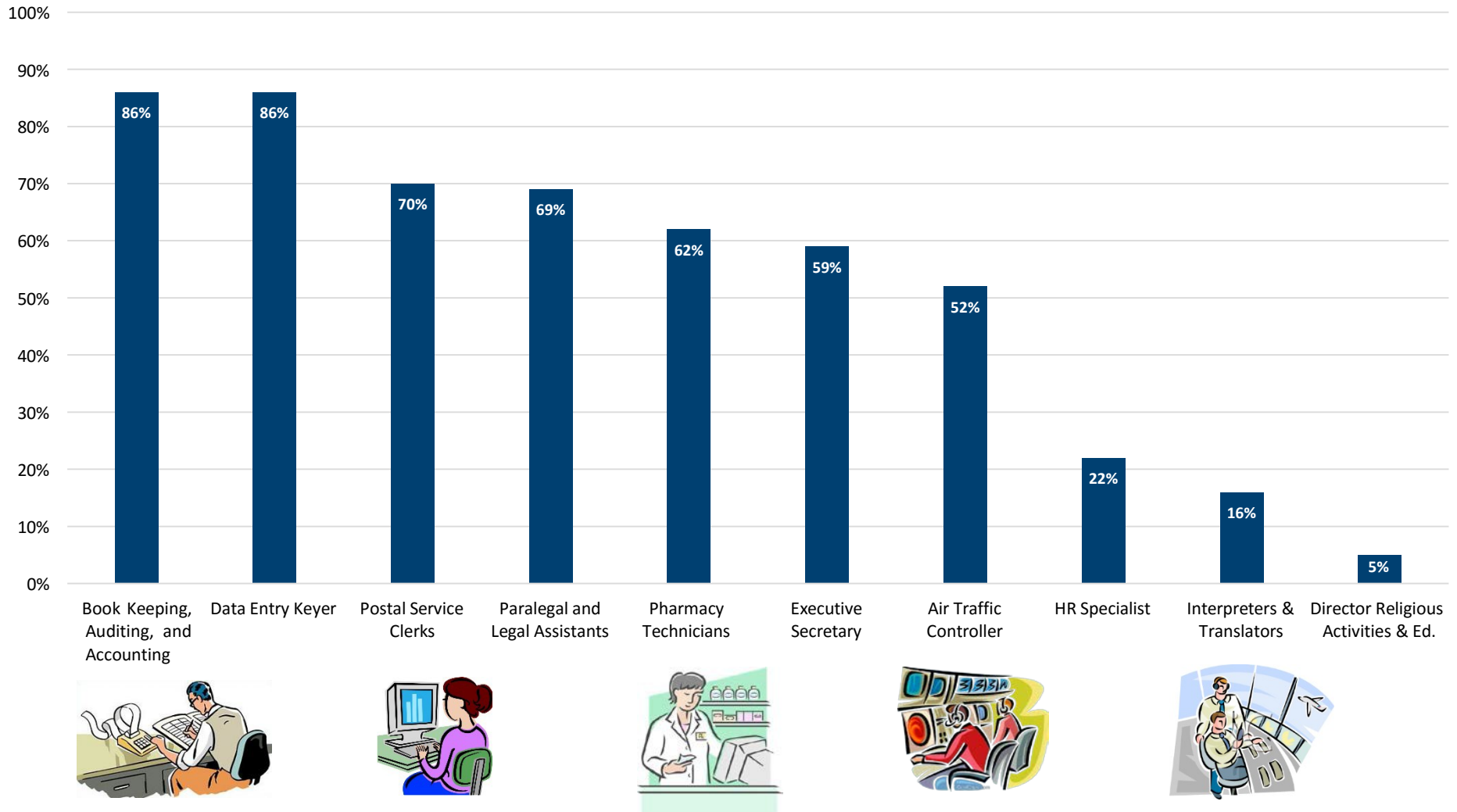
Why it Matters to the Department of Defense

- By applying automation to business processes, the Department can:
  - Accurately track financial and resource data
  - Improve management effectiveness
  - Increase decision-making speed and accuracy
  - Analyze and solve more complex problems
  - Generate second and third order solutions not presently available

- Doing this will enable:
  - The defense industrial base to obtain similar benefits and significant cost savings
  - Talent to be reallocated for core missions by reducing FTEs associated with business processes
  - Realization of a technology offset program (specifically per Sec 218 of the FY16 NDAA)

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Approach and Methodology

- The Task Group took the following approach and methodology:
  - Literature review and independent research on current trends in academia and think-tanks to gain perspectives on automation
  - More than forty-five private sector and DoD interviews to develop an understanding of automation benefits and progress across a broad range of private sector companies and DoD, including defense agencies and military services
  - Identified most beneficial automation opportunities for DoD as well as best practices for implementation
  - Developed recommendations and implementation strategies

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Observations & Findings: Private Sector

Automation as a Continuum

- **High maturity**
- **Internal ops focus**
- **Rapid Benefits**
- **High volume process**

- **Higher "intelligence"**
- **More customer-facing**
- **Longer time to benefit**
- **Complex query management**

Scripting Assisting Activities		Replacing Executing Processes		Deciding Assisting Decisions
Desktop Automation	**Mini-bots "Phantom FTE"**	**Robotic Process Automation**	**Digital Assistants**	**Cognitive Computing**

Description

Desktop Automation	Mini-bots	Robotic Process Automation	Digital Assistants	Cognitive Computing
• Basic "Arms" • Software programming that consolidates from multiple sources into a single view to streamline a process	• Simple "Bots" • Applying technology to automate simple tasks and activities	• Virtual "Workers" • Scheduled engine mimics execution of manual user's repetitive activities without requiring intervention or assistance to automate more complex, yet predictable processes	• Smart "Hybrids" • Execute user or client conversations through a computer0generated character that can answer questions or queries and provide guidance	• Cognitive "Brains" • Systems that gain knowledge from data as "experience" and generalize what is learned upcoming situations to change processes

Use Case

Desktop Automation	Mini-bots	Robotic Process Automation	Digital Assistants	Cognitive Computing
• Populating a field in one tool automatically populates the same field in multiple other tools	• Up-and downloading documents, mass printing and email	• Automatically detecting and filling missing information in a CRM system (customer Relationship Management)	Communicating with customers through the telephone using natural language processing	• Enhancing trading algorithms using deep learning

Benefits

Implement in only a couple of weeks 20%-50% FTE	30% Accuracy	10%-50% Productivity 30% Management Time	20% ROI Optimization 60% Staffing Optimization	25% Faster Execution

Source: Accenture

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Automation Benefits in Private Sector…

- Data Processing
  - Reduced paper forms, people entering data, process errors, and cycle times
  - Process larger volumes of data and better data analytics
  - Increased accuracy and speed of decisions
  - Higher customer satisfaction levels
  - Decreased labor and operating costs
  - Increased employee productivity
  - Improved audit and regulatory compliance

- End-to-end Process Efficiency and Effectiveness
  - Process simplification and further reduction of processing times
  - Complex problem solving and monitoring
  - Elevated employee engagement and satisfaction
  - Increased compatibility and integration between business processes and IT systems

…Are Diverse Across Sectors…

International Tech Provider	Multinational Consultancy	Fortune 50 Health Insurance Company
– 50% reduction in operating costs	– Reduction in FTE's - 30% FTE's retained and reskilled – retraining programs	– Cost savings: $200 million in a $3 billion space
– $50 billion company with 75k employees	– Business Process Outsourcing (BPO) service provider - Automates back-office processes across healthcare, banks and financial organizations, telecom industry	– 1.7 million claims/day
– Acquired 150 companies over a 15 year period		– 92% via automated clearing house
– 3000 workers doing transactional work – current focus for automation		– 75% solved via automation
– 40% cost reduction per transaction	– 20-40% processes are suitable for automation (task automation)	– 25% manually adjudicated
– 50% cost savings gained through process reengineering & automation	– 70% processes do not require reengineering	– 4-8 months to see ROI from process reengineering & automation
– Reduction in personnel doing repetitive tasks - data entry	– 10-12 weeks to implement RPA for simple processes w/in back-office functions	– Invested in process engineers and data scientists for data analytics
– Increased responsiveness – logistics		– Significant reductions in time, claim fraud, waste and abuse, and increased volume of claims processed

…And Healthcare

Robotic Pharmacy Service Provider

Automated pharmacy – customer focused pharmaceutical dispersing and management to optimize retail and ambulatory services

- Automation ROI upwards of 900% with incorporation of inventory management systems and Chronic Care Systems*

- Provide a 50-60% decrease in FTE workload,

- 99.5% system reliability rate

- 99.7% accuracy rate

- 150 prescriptions/hr – 225 prescriptions/hr (machine dependent)

- Average cost is $400-$800K/unit

*DoD has 700+ automated pharmacies, but does not purchase these services.

University Medical Center Automated Pharmacy

Automated pharmacy – university medical center focused on the preparation and tracking of medications with the goal of improving patient safety.

- Same # of FTE's - 2X or greater work output

- Reduction in FTE workload resulted in shift of FTE's to other duties (focus expertise on direct patient care and interaction)

- 0 errors per 350,000 doses of medication prepared

- Increased volume, decreased time of distribution

- 2-3 yrs to break-even/capture costs – (did not conduct process analysis and process reengineering upfront) - "Requires change leadership" – resulted in delayed ROI - 5-6 years for full ROI

Outcomes of Automation on the Private Sector

On the Organization	On the Employee
Companies see increase in speed, accuracy, and volume; reduction of errors; increases in safety, elevated levels of customer satisfaction and budgetary savings	Reduction and/or elimination of dull, routine, repetitive tasks
CEOs can manage organization more effectively	Elimination of reworking completed tasks to fix errors in a process
COOs can streamline and rationalize work, maximizing efficiency	Refocus of time and effort on higher level cognitive tasks requiring soft skills like, creativity, judgement, empathy, and emotion
CFOs can more easily audit the organization	Higher job satisfaction
CIOs can gain a bridging solution between modernization and recapitalization of large IT systems	If task is transactional and rules-based, then FTE workload can be reduced

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Private Sector Automation Roadmap

- Identify opportunities to automate
  - Match right tool (automation) to right problem and business endstate/ROI
  - Not every process needs automating…
  - Target labor intensive, repetitive, error-prone processes

- Validate and prepare the opportunity
  - Understand the upstream and downstream impact
  - Rationalize, understand, and reengineer the end-to-end business process

- Select a design model and capability acquisition plan
  - Outsource, Outsource-to-Insource, Insource
  - Centers of Excellence for capacity building

- Develop automation plan, governance, and infrastructure

- Design and execute demonstrations

- Scale and sustain
  - Replicate the value into new demonstrations and new business processes
  - Reinvest savings into future projects

- Design new processes and obtain next generation benefits

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Common Denominators Underpinning Success

Six interrelated foundational elements account for
successful deployment of automation in business processes

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Observations & Findings: DoD
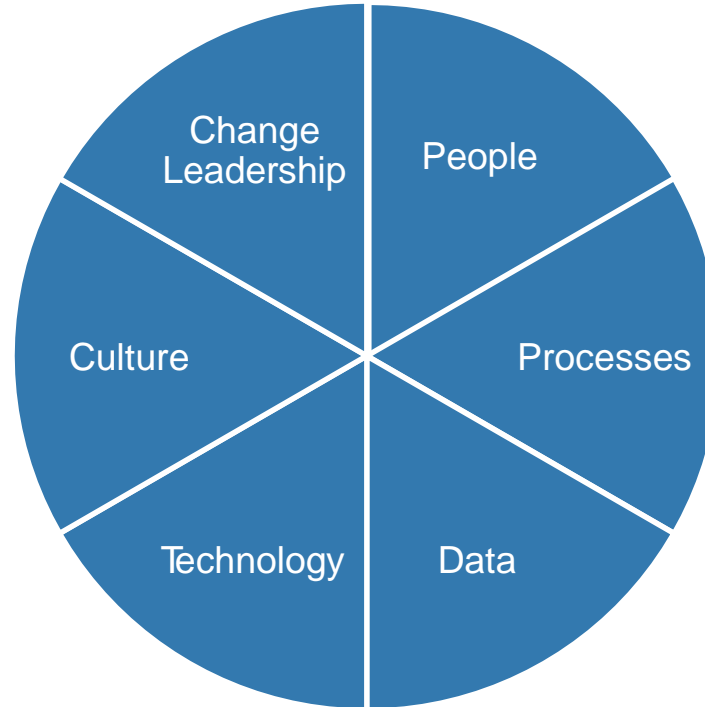
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Bottom Line Up Front

- DoD will benefit from an enterprise-wide implementation of automation across business functions

- Currently in DoD, there is limited appreciation and application of automation in business processes in contrast to the extensive application toward warfighting, e.g. the Technology Offset Program

- The Congress, President, and Secretary have mandated improved business efficiencies within the DoD

- DoD business processes are very similar to those in the private sector, thus significant opportunities exist to improve the quality and speed of decision making and reduce costs

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DoD Data

- DoD has insufficient data on its business processes and workforce statistics to determine which tasks can be automated
    - Business Enterprise Architecture (BEA) Level 4 analysis, which addresses manual versus automated transactions, is minimal
    - Enterprise-wide enforcement of compliance is sporadic
    - Inadequate incentive to conduct Level 4 analysis and make change
    - Without adequate data, DoD is challenged to justify investment in automation technologies because return on investment (ROI) cannot be calculated

- Cultural resistance to sharing data is pervasive and limits DoD's ability to deploy automation at scale
    - DoD data exists in siloes and access is restricted
    - Loss of ability to control data is considered a loss of status and power
    - Aggregation of data is seen as a cybersecurity risk

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DoD Culture and Talent

- Organizational culture does not encourage business process automation
  - Low interest in the improvement of business processes- "DoD doesn't promote from it, DoD doesn't incentivize it, often viewing it as an afterthought."
  - Achieving efficiencies and cost savings reduces budget and/or headcount, which is considered a loss of status
  - Rewards for success in business operations are not proportional to risks taken – weak incentives to improve, yet penalties for failure are substantial

- Workforce skills required for automation are insufficient
  - Talent required to start and scale automation is in short supply, especially business process engineers, software engineers, computer and data scientists
  - Combination of adverse culture and limited incentives is a challenge to recruiting and retaining highly motivated, well educated, technically skilled and innovative workers

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DoD Management and Governance

- **Duplicate and siloed business processes across the enterprise**
  - AT&L, P&R, Comptroller, DCMO, DoD CIO each manage their own specific business processes
  - In contrast, services each maintain duplicative business processes
  - Fragmented process ownership and business systems inhibit enterprise business process reengineering

- **Governance constraints limit DoD's ability and agility to implement projects such as automation**
  - Congressional
    - Multi-year budget process requires overly-precise planning, which is especially difficult with rapidly evolving technology
    - Delays with available and accurate fiscal year funding make planning and execution difficult
  - Certification and Procurement Limitation
    - The mandates of Defense Business System certification cause limits on agility and result in inefficiencies
  - Regulatory
    - Federal and DoD acquisition regulations limit ability of DoD to collaborate with the private-sector for business process innovation

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DoD Success: Case Study on DLA

- Automation continuum deployment has resulted in the following outcomes:
  - Since 1992, workforce has been reduced from 61K to 25K
  - Since 2001, same number of FTEs with an increase in business from $17B to $42B

- Key Success Factors
  - Progressive vision with committed senior leadership
  - Continuity in leadership, change management governance discipline, and devotion to building organizational capacity
  - Strong employee engagement encouraged by the leadership coupled with ROI and continuous improvement mindset to shape the culture in the following areas:
    - Reporting and Data Collection
      - Reporting with today's COTS tools
      - Big data and a data governance board
      - Comprehensive data repository for reporting and analytics
    - Analysis and Insights
      - Enterprise level metrics/drilldown
      - Ad hoc analysis – easy to use
      - Issue driven insights
    - Advanced Analytics
      - Enterprise Presence Capability
      - Business Decision Analytics
      - Predictive modeling and self service visualization
      - A platform that analysts can grow into

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Summary of Findings

- Automation of business processes within the DoD, including finance, personnel, healthcare, logistics, and acquisition, can provide the following benefits:
  - Automation of transactional administrative business processes
  - Achievement of more accurate financial and human resource tracking
  - Improved effectiveness of management through increased speed and accuracy of decision making
  - Higher order of data analytics for system monitoring and responsive problem solving
  - Generation of second and third order solutions not presently available
  - Enhanced cost transparency with defense suppliers in the acquisition process
  - Realization of enhanced talent management through:
    - Reduced number of FTEs assigned to manual transaction processing
    - Curtailment of the growth of personnel assigned to business processes
    - More robust talent development and meaningful careers for civilians

Recommendations

Recommendation 1

- Automation as a Strategic Enabler -

- Create and promulgate a strategic vision for automation and the future force to achieve the following:
  - Increase quality, volume, speed of business decision making
  - Greater access to resources and accurate information in support of warfighting
  - Accelerate Technology Offset Program by applying automation to business processes
  - Reduce and reallocate personnel performing business processes and reduce costs, especially labor costs
  - Close the gap between future workforce needs and anticipated shortfall of talent

- Develop an enterprise strategy that prioritizes use of automation to significantly improve the quality and cost of business processes
  - Leverage private sector experience, which is accessible and readily applicable, to optimize defense business processes
  - Develop metrics to measure automation ROI to ensure automation efforts and dollars are applied correctly
  - Improve the quality of manpower data needed to quantify the impact of automation
  - Define redeployment strategy and plan for impacted employees

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Recommendation 2

- Leadership Actions -

- DepSecDef should mandate business process reviews to identify automation opportunities at the enterprise-wide and component levels
  - CMO should lead the initiative
  - Set and promulgate objectives, milestones, metrics, and timeline
  - All business functions to provide a plan on where automation can be applied, and if appropriate, integrated with other enterprise wide functions – use the current DLA pilots as thought starters

- Empower lower levels of management to both lead and effect change

- Manage business operations as aggressively as DoD manages the development and conduct of warfighting

- Develop a strategic communication plan to emphasize and educate the value of automation of business functions
  - Create Automation 101 briefings
  - Educate senior and mid-level leaders on automation and its benefits in order to create a natural demand signal and empower all levels of leadership
  - Communicate the technology offset program in terms of business operations as well, not just the application of warfighting

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Recommendation 3

- Build Capability and Capacity -

- DoD should establish a Business Operations Center of Excellence
  - Establish and enable governance of automation efforts
  - Provide guidance and support for demonstrations and trials to maximize success
  - Partner with private sector and academia to build talent capacity
  - Internally share best practices and processes
  - Ensure continuous process improvement – second and third generation automation opportunities
  - Support and advise on technology, vendor oversight, and program management

- Establish an Autonomy University Affiliated Research Center (UARC) (DIB Recommendation)
  - Establish a university-based center that focuses on innovation, information, and best practices
  - Address challenges and problems associated with the maturation of the automation continuum

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Recommendation 4

- Develop Automation Talent -

- **Build talented teams to design and implement RPA and AI projects**
  - Recruit a critical mass of leaders, managers, and technical support personnel who understand RPA and AI and have the capability to lead change
  - Supplement with external partners as necessary to build competency and transform DoD's workforce and culture

- **Define and build professional career paths for new critical skills**
  - Includes data scientists, software engineers, process engineers, etc
  - Partner with private sector to expand corporate fellowships and other similar private sector exchange programs to gain exposure to new skills and ways of thinking

- **Apply Human System Integration (HSI) tenets to automation of business processes**
  - Focus on and incorporate design thinking and impact of the human factor
  - Ensure HSI billets support the program and resource managers in understanding the productive benefits of designing at the interface between humans and machines
  - Expand population of professionally educated HSI professionals

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Recommendation 5

- Methods to Facilitate Adoption -

- Conduct high-profile demonstrations and competitions to increase awareness and develop world-class solutions
  - Encourage open innovation throughout DoD and its suppliers to increase development of new business processes and technologies

- Develop an RPA/AI self-assessment tool to identify business process automation opportunities
  - Use results to generate internal change and reduce cultural resistance

- Leverage challenge communities to solve business process problems
  - Utilize challenge communities including MD5 at National Defense University and other best-of-class Services' innovation cells
  - Use crowdsourcing forums to support improvement and automation of business processes
  - Incentivize workforce to work on business process problems

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Conclusion: Automation Provides Strategic Advantage

- Automation of business processes and warfighting are inextricably linked

- It is a true Offset as it will revolutionize the effectiveness of both business processes and warfighting

- It will enable the United States to have a major competitive advantage in shaping global stability and warfare, especially with respect to peer-competitors and our current enemies

- Automation will be to business processes as stealth and precision were to warfighting – a once in a decade opportunity to dramatically reshape DoD business operations

- The use of automation will attract and retain a more innovative and competitive workforce and create a more productive workplace

- Enhanced quality of data and decision-making will provide better, faster, and more accurate outcomes at lower costs – resulting in more efficient use of resources and better support to the warfighter

- The substantial reduction in costs, primarily in the reduction of FTEs, will free up human and financial resources that can be transferred to expand and enhance DoD's warfighting capability₃₀

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Implications of Technology on the Future Workforce

August 2, 2017

HON. Jerry Hultin   **Dr. Cynthia Trudell**   **Mr. Atul Vashistha**   **Mr. Taylor Glover**

CAPT Garrett Campbell, USN Representative
Capt Thomas Koch, USMC Representative

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Appendix Slides

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Escalating Personnel Costs

Personnel Costs Per Active Duty U.S. Service Member, 1998-2014
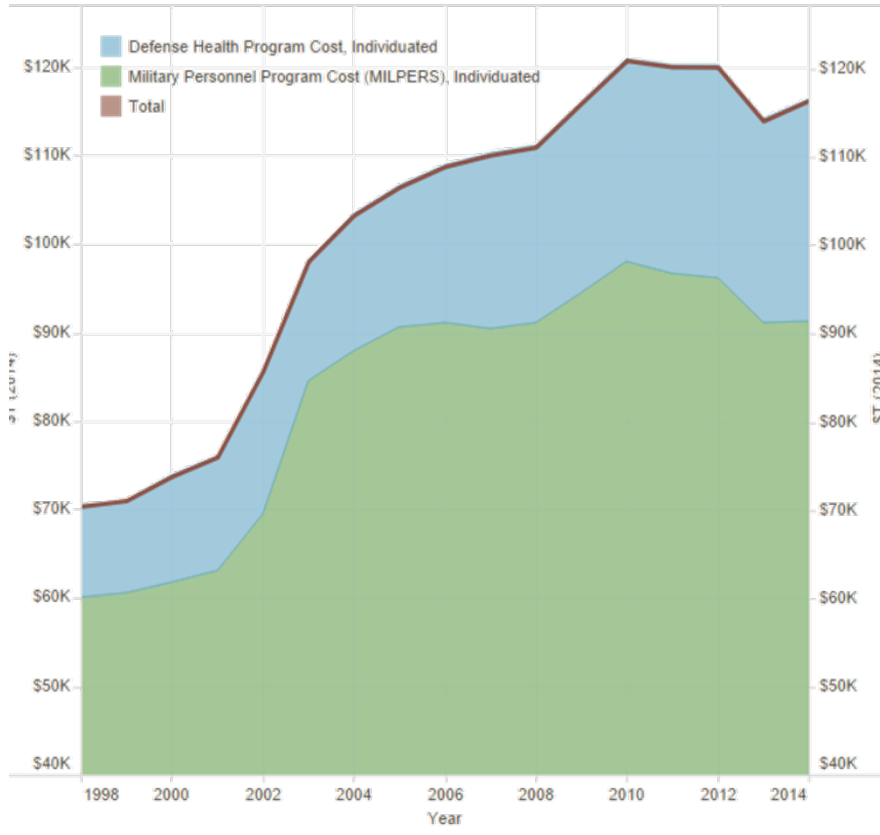
- Defense Health Program Cost, Individuated
- Military Personnel Program Cost (MILPERS), Individuated
- Total

Total Military Compensation Funding in FY15 Federal Budget: $441B

(includes total discretionary and mandatory funding and lost revenue from tax expenditures)

- Veterans' Benefits and Services, $160.6B
- DoD (includes military healthcare), $178.4B
- Treasury Payments to the Military Retirement Fund, $75.6B
- Treasury Payments to the Retiree Health Care Fund, $4.0B
- Military Tax Expenditures, $13.6B
- Veterans' Tax Expenditures, $8.4B

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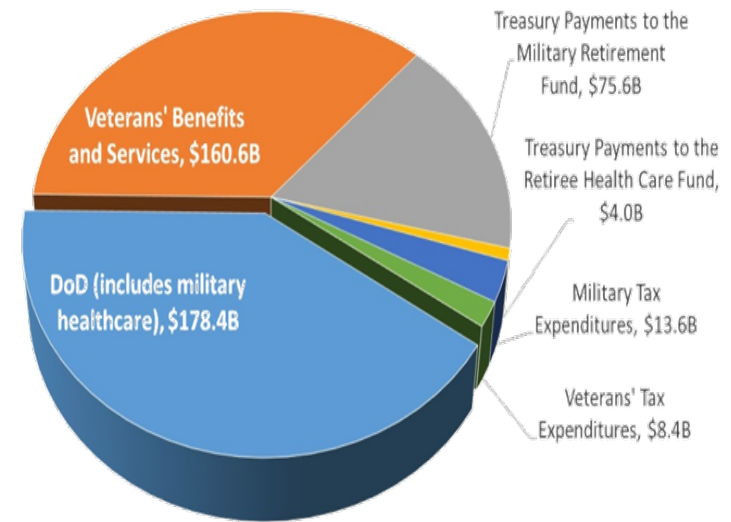
Future Recruiting Challenges

Iraq Surge

9/11

Iraq Operations End

Significant Combat Operations

*Cost Per Recruit in constant dollars
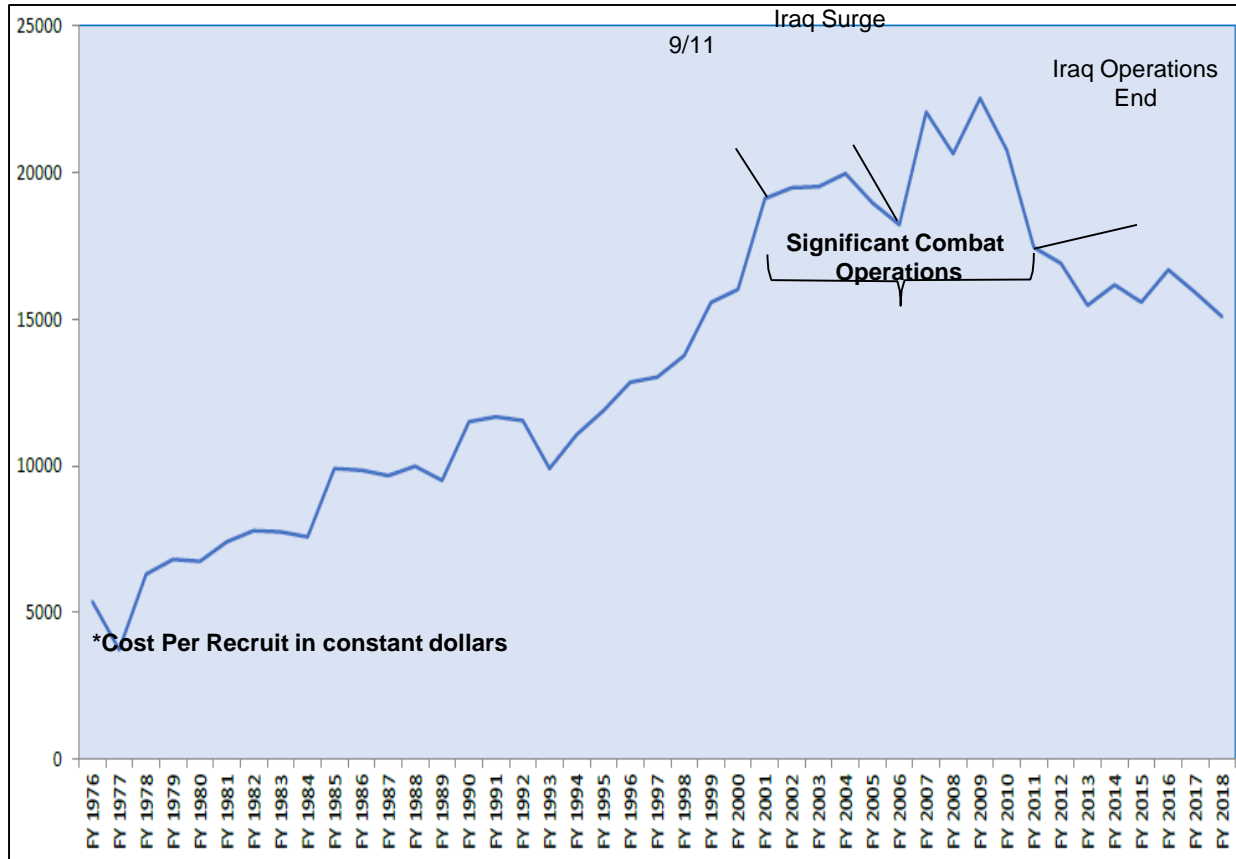
Source: OUSD(R&R) / Military Personnel Policy

Seventy-one percent of young Americans are ineligible for military service

Unable to join 71%

Able to join 29%

5.8 out of 34.4 million 17-to-24 year-old Americans
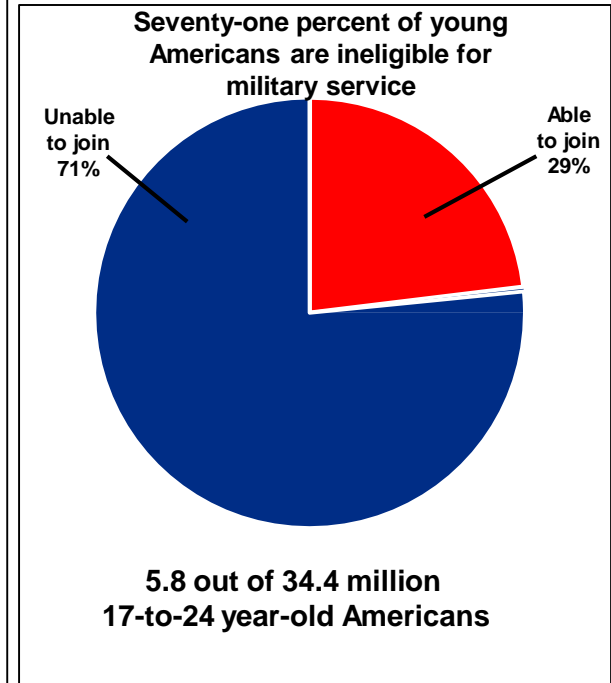
Source: DoD Qualified Military Available Study 2013

*Ineligibility based on failure to meet physical, moral, and or other qualification standards

The cost to recruit the future force may increase if there is an increased demand for technologically skilled and educated recruits and the limited pool from which to recruit

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Low Probability of Additional Funding

Billions of 2015 Dollars
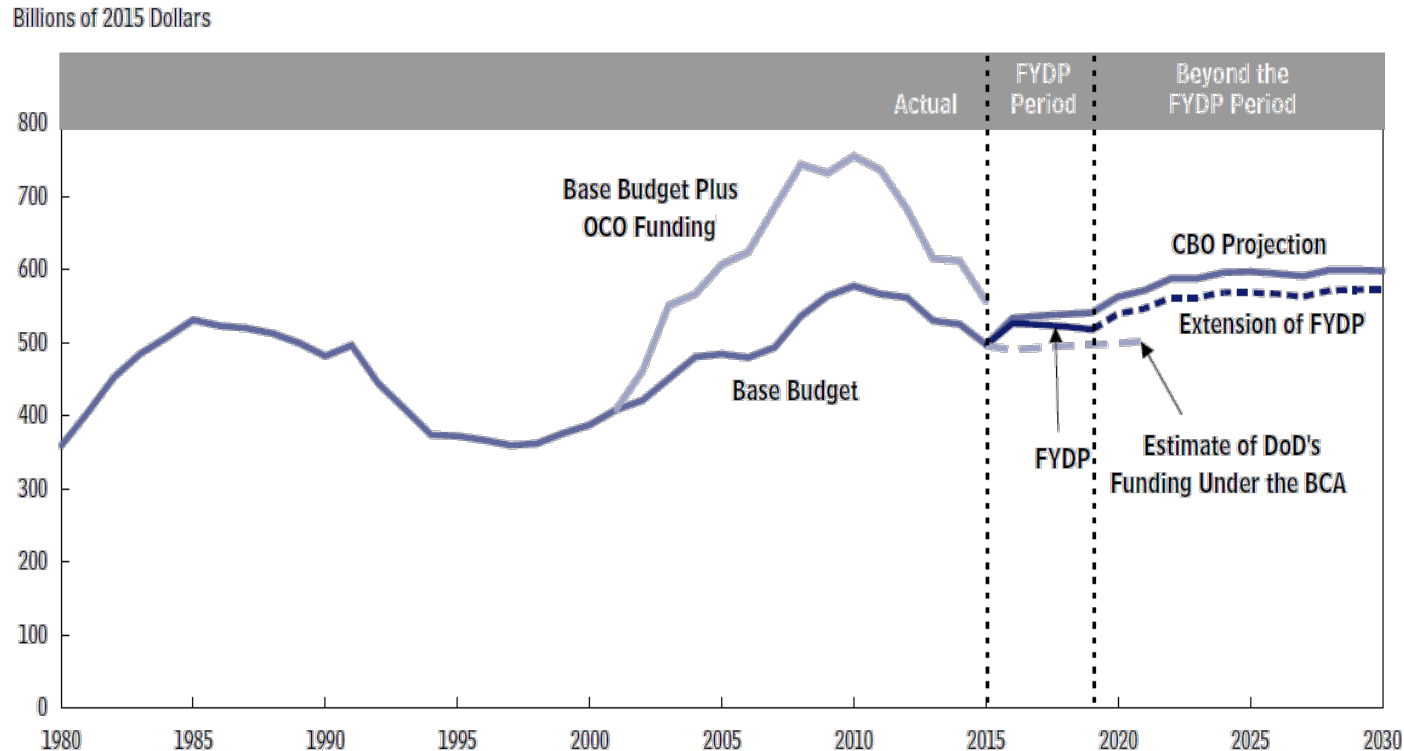
Source: Congressional Budget Office.

DoD must adapt to a new business environment; one that requires reduction of costs AND enables a better approach to the challenges and opportunities confronting it.

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Industry & Academia Interviews

- Amazon

- Bitfury Group

- BNY Mellon

- Bloomberg Beta

- Blue Prism

- Cognizant

- Deloitte

- Facebook, AI Research

- IBM Watson

- McKinsey Global Institute

- MIT Sloan School of Business

- Northern Trust

- Phasic Systems

- Professor and author, "A New Approach to Automating Services"

- ScriptPro

- SVP Cisco

- United Health Care

- University California San Francisco Pharmacies

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DoD Interviews

- Army G-1, Human Systems Integration
- CTO, DIUx
- DCMO, OSD
- Navy DCMO
- USAF DCMO
- Defense Digital Service
- Deputy CIO, OSD
- Director, CAPE
- Director, Defense Innovation Board
- DISA
- Federal CIO Council, OMB
- Former USD P&R
- Marine Corps Operational Test Activity
- Marine Corps Warfighting Lab
- MD5 National Security Technology Accelerator

- Naval Post Graduate School, Human Systems Integration
- Navy Office of Strategy and Innovation
- Office of Business Transformation, US Army
- Office of Total Force Manpower and Resources, OSD
- Office of the Federal CIO, OMB
- Office of the US Digital Service, OMB
- OPM Government Innovation Lab Forum
- OPNAV N1, MPTE Transformation Office
- Program Manager, Universe of Transactions, OSD Comptroller
- Robotics and Autonomous Systems Team, Joint Staff J8
- The Innovation Lab at OPM
- OUSD AT&L

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Automation's Impact…

Metric	International Business Process and Tech Services provider	International Telecom	UK Energy Supplier
Processes automated	14	15	60
Automated transactions per month	120,000	400,000-500,000	~1m
Bots	27	160+	300+
FTE replacement	N/A	100+	600+
Cost savings	30%	ROI 650-800%	200%

Source: Data provided through interviews with industry

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Fundamentals: What Industry has Learned

- Common Denominators Underpinning Success -

- **Processes** – Business process analysis and reengineering is essential. Start at the problem, not the solution (IT). Bad processes = bad data, inefficient use of IT, under-utilized people, and worker disempowerment

- **Data** – Single source of truth data requires process reengineering, properly skilled people, cultural transparency, and leaders who understand and pursue its value and application

- **Change leadership** – Dedicated sponsorship and governance of automation efforts is fundamental to success. Top down involvement fosters bottom up empowerment creating a culture of continuous process improvement

- **Culture** – Creating an agile and innovative culture focused on continuous process improvement requires leadership, the right professional skillsets, and processes and data accuracy

- **Technology** – IT solutions are readily available. The right IT to support efficient and effective business processes is important, but, but process analysis and subsequent reengineering is more important

- **People** – Successful automation efforts require an understanding of what people are doing within processes and the right mix of a professionalized workforce that possess the necessary skills to properly analyze, implement, and leverage the benefits of automation

Six interrelated foundational elements account for successful deployment of automation in back-office functions
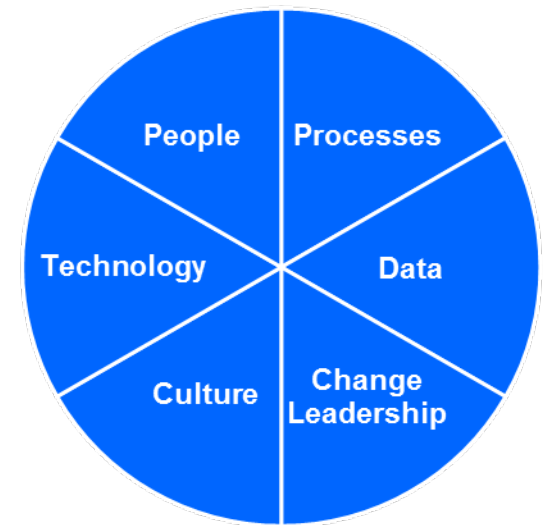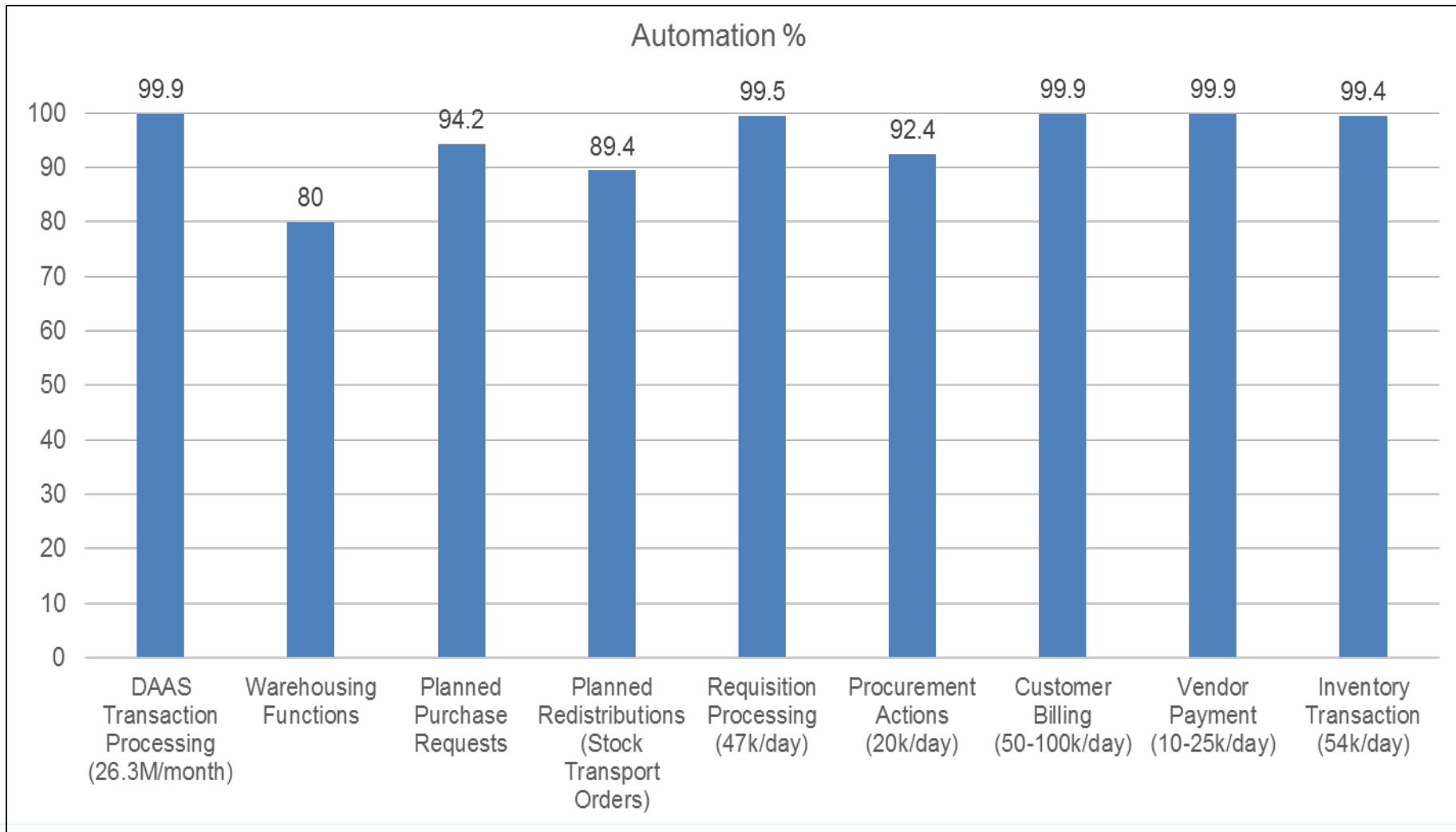

Automation of back-office functions is best done in bite-size portions, involves rigorous focused pilots with continuous test and evaluation. Then increase the scale of projects.

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Diverse Perspectives on the Impact on Jobs

OECD	McKinsey Global Institute	Deloitte Center for Government Insights	International Federation of Robotics	University of Oxford
http://www.oecd-ilibrary.org/social-issues- migration-health/	http://www.mckinsey.com/glob al-themes/digital-disruption/harnessing-automation-for-a-future-that-works	https://dupress.deloitte.com/d u p-us-en/focus/cognitive-technologies/artificial-intelligence-government.html	https://ifr.org/img/office/IFR_T h e_Impact_of_Robots_on_Em pl oyment.pdf	http://www.oxfordmartin.ox.ac. uk/downloads/academic/The_ F uture_of_Employment.pdf
"…On average, across the 21 OECD countries, 9% of jobs are automatable."	"…Less than 5% of all occupations can be automated entirely… ~60% of all occupations have at least 30% of constituent activities that could be automated."	Potential of between 96.7 million and 1.2 billion federal government hours annually saved.	"Robots substitute labor activities but do not replace jobs. Less than 10% of jobs are fully automatable."	"…47% of total US employment is in "high risk" category [for automation]…"
"…Automation and digitalization are unlikely to destroy large numbers of jobs. However, low qualified workers are likely to bear the brunt of the adjustment costs…"	"The right level of detail…to analyze the potential impact of automation is that of individual activities rather than entire occupations. Every occupation includes multiple types of activity, each [having] different requirements for automation."	"In the near term…large government job losses are unlikely. But cognitive technologies will change the nature of many jobs…freeing up to one quarter of many workers' time to focus on other activities."	"Automation has led overall to an increase in labor demand and positive impact on wages….The issue is how to enable middle-income earners in the lower-income range to upskill or retrain."	"…[Reduction in] aggregate demand for labor input in tasks that can be routinized by means of pattern recognition, while increasing the demand for labor performing tasks that are not susceptible to computerization."

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DoD Success: Case Study on DLA

Automation %

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Opportunity of Automation

Automation in routine back-office business processes offers:

- More and cleaner data entry for processes and analysis
- Ability to analyze data to increase quality, volume, speed of decisions
- Faster, more accurate, and higher volume business transactions
- Reduction of costs (particularly labor costs) and errors
- Reduction or reallocation of FTEs performing routine functions to higher level tasks and more important functions

"…Less than 5% of all occupations can be automated entirely… ~60% of all occupations have at least 30% of constituent activities that could be automated."

~ McKinsey Global Institute

Defense Business Board

TAB C

PUBLIC COMMENTS

SUBMITTED TO THE DEFENSE BUSINESS BOARD

Defense Business Board

PUBLIC COMMENTS

As of the date of this study being published two public comments were received by the Defense Business Board:

1. A letter dated August 3, 2017, from Michael A. Aimone, P.E., Founder and Chief Data Officer, Energy Management & Analytics, LLC

2. A letter dated October 27, 2017, from Robert L. Walter IV, Senior Research Engineer, Systems and Operations Automation Division, Pennsylvania State University Applied Research Laboratory

The letters are included in their entirety.

Defense Business Board   August 3, 2017
Michael J. Bayer, Chairman
The Pentagon
Washington DC

Dear Mr. Bayer,

        This letter provides public comments on the <u>Implications of Technology on the Future Workforce</u> report, presented at the August 2, 2017 DBB meeting.   I share the Board's view that this report was well researched and provides the DoD leadership a set of actionable recommendations that will enhance the efficiencies of the Department "backshop" activities.

        I have two comments regarding the subject report that the Board may wish to consider:

-   First, I thought that the authors could have discussed the nexus between the next generation commercial business (IT) systems and the "Internet of Things". The Board may wish to ask the proposed Automation University conduct experimentation and dem/val of this nexus to assess the impact, and potential efficiencies that could be garnered by the workforce.

-   Second, the report authors discussed the cyber concerns associated with the aggregation of data – especially when aggregated across multiple defense business organizations. However, the Board may wish to consider the impact if this otherwise unclassified information, when aggerated, could become classified information. This issue created a significant impact during the 2005 BRAC round, and a well-constructed data management plan, that examined the impact of aggerated data across organizational boundaries, might have anticipated this classification issue and provided management solutions, short of classification of the data in the aggerate. There are lessons learned that may be applicable to this report, and again the Board may wish to ask the proposed Automation University to examine this issue, in light of the lessons learned from the last BRAC round.

        Thank you for the opportunity to comment.

                                Sincerely,

                                // electronically signed//

                                Michael A. Aimone, P.E.
                                Founder and Chief Data Officer
                            Energy Management & Analytics, LLC
                                    4835 Powell Rd
                                  Fairfax, VA 22032

MEMORANDUM

Date: October 27, 2017

To: Ms. Roma Laster, Executive Director, Defense Business Board

From: The Pennsylvania State University Applied Research Laboratory

Subject: Offer to Support DBB Recommendations for Automating Business Processes

The recent briefing published by the Defense Business Board (DBB) entitled <u>Implications of Technology on the Future Workforce</u> analyzes the private sector's adoption of automation technology in a variety of business processes. Automation tools and processes have the potential to increase the efficiency of the federal workforce but must be implementable within the unique constraints of the government's technical landscape. The Pennsylvania State University Applied Research Laboratory (PSU ARL) currently supports the US Navy, Army, and Marine Corps in business system optimization, implementation, and technical migration in areas that directly support the DBB's recommended courses of action.

PSU ARL is an established University Affiliated Research Center (UARC) for NAVSEA. Focusing in undersea systems, PSU ARL's capabilities have extended into information systems, materials, manufacturing technologies, logistics, and the business systems that support continued operations. The Systems and Operations Automation division is dedicated to the development, integration, and implementation of advanced tools across the automation continuum.

PSU ARL works with the larger Penn State community to draw on subject matter expertise in relevant areas. Specifically, the College of Information Sciences and Technology and the Smeal College of Business. These institutions represent thought-leadership in the areas of supply chain management and enterprise architecture amongst many others. This knowledge base, combined with PSU ARL's applied research focus, directly supports DBB's recommendations on building automation capabilities within DoD.

1. **Recommendation 1 – Automation as a Strategic Enabler**. PSU ARL's mission is to provide research, education, and transition capabilities to DoD. Part of that mission is to educate the future workforce in evolving technologies such as data science and analytics that are used to support business process automation. ARL delivers talent with necessary skillsets to DoD to advance mission capabilities throughout the commands.

2. **Recommendation 3 – Build Capability and Capacity.** DBB recommends establishing a Business Operations Center of Excellence in partnership with industry and academia. With PSU ARL's demonstrated success in support of Army, Navy, Marine Corps, and Defense Logistics Agency lab personnel have a unique view of automation opportunities and best practices throughout DoD and can provide this expertise to such a Center of Excellence.

    DBB also recommends establishing an Autonomy UARC to focus on innovation, information, and best practices. PSU ARL is supporting DoD as Navy's second largest UARC in several areas,

including automation and business systems optimization. Capabilities and resources in these areas continue to grow, and are available to all of DoD.

PSU ARL looks forward to supporting DBB's recommendations to advance the adoption and institutionalization of automation technologies in the DoD landscape using existing capabilities. As an established UARC, PSU ARL can respond quickly to DoD requirements to evaluate opportunities for automation, prototype automation technologies, test proposed solutions, and advise on implementation strategies.

I visit the Washington DC area often and plan to attend the DBB meeting on November 8. I would like to provide a more complete capabilities briefing to appropriate stakeholders when your time permits and determine if PSU ARL capabilities match some of your requirements. I look forward to advancing DoD's capabilities across the automation continuum.

Respectfully,

Robert L. Walter IV
Senior Research Engineer
Systems and Operations Automation Division, Deputy
The Pennsylvania State University Applied Research Laboratory
814-863-8876, RLW9@arl.psu.edu

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TAB D

DoD COMPONENT RESPONSES

PROVIDED TO THE DEFENSE BUSINESS BOARD

Defense Business Board

RECLAMAS

As of the date of this study being published no Department of Defense component responses were received by the Defense Business Board for inclusion.

Defense Business Board

TAB E

Backup-Slides / Appendices

BACK-UP SLIDES / APPENDICES

Many DBB studies include back-up slides or appendices which offer additional information in addition to the briefing provided to the DBB members at public meetings.

Back-Up Slides / Appendices are intended to provide DBB members additional information on complex topics and issues that the task group utilized to formulate the recommendations presented. The slides are not normally presented as part of the brief given during the public meeting, unless required by the briefer to further clarify or elucidate a particular observation, finding, or recommendation.

Appendices 1 through 6 are included as supplemental information to the background, research, analysis, findings, conclusion, and recommendations of the task group.

Tab E - Appendix 1

Orientation to "Autonomy"

Every industry is undergoing change from new, "disruptive" technologies. As discussed in the introduction, the convergence of cheaper and faster computing power, low-cost and larger data storage, and advanced algorithms is leading this change in academic settings, start-ups, and R&D centers in industry. These technologies include, but are not limited to, virtual reality (VR), natural language processing (NLP), computer vision (CV), and quantum computing. The maturity of these technologies, and the pool of feasible use cases, is rapidly growing.

Beyond using these technologies, many organizations are undergoing general "digitization" projects which aim to take "how" they do business and put it into a digital format on digital platforms. These projects are generating value for these organizations in many respects, including the ability to subsequently use some of the aforementioned "new" technologies as digitization projects scale and mature.

In this study, the task group wanted to explore technology that, in general, was showing the most concrete results in creating additional business value for private sector businesses. For this reason, the task group focused on "automation" technologies and their application to business functions within organizations. The task group looked at new business process automation tools, referred to in industry as robotic process automation (RPA), at the beginning of the automation capability continuum, and examined how it is impacting industry.

Automation means many different things to many different people. This makes it difficult to understand and talk about. Different companies have different, proprietary ways of describing automation, and the US federal government does not have any codified definitions for this type of automation.

One way to think about automation in the context of business processes is to consider it in the abstract as a "continuum of capability." The following chart, Figure 1, from the consulting firm Accenture, is a helpful guide to understanding this point. Focus your attention on the description portion of this visual, from left to right, and you can get a sense,

at least from the point of view of Accenture, of what the spectrum of capability is. Also note the use of the term "robotic," a fairly accepted term used across industry, to describe "bots" (again, another generally accepted industry term) in the context of business process automation.
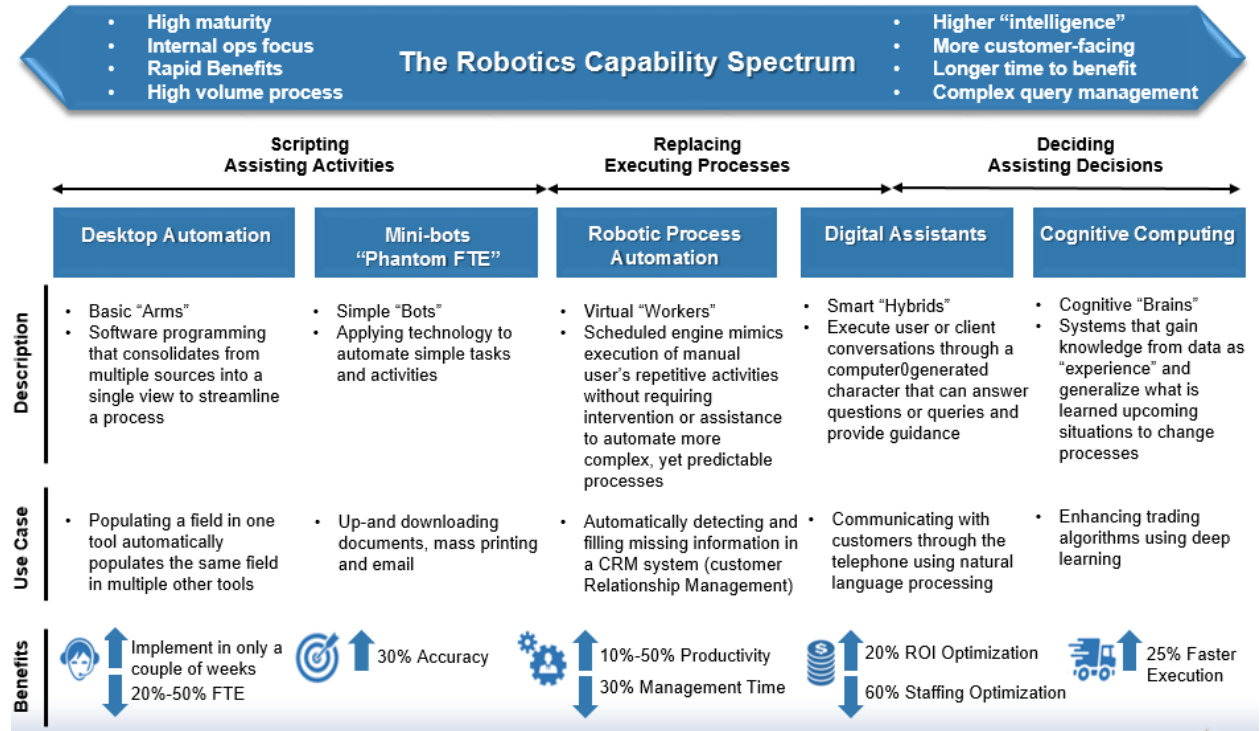
Figure 1: The Robotics Capability Spectrum (Source: Accenture)

Another way to think about automation in business processes is to consider the human touchpoints within the system. In general, these types of human interventions can be plotted on a spectrum from fully manual to fully autonomous, with different types of interventions in between. Figure 2 helps make this point.

Relative Levels of Human Control in Autonomous Systems
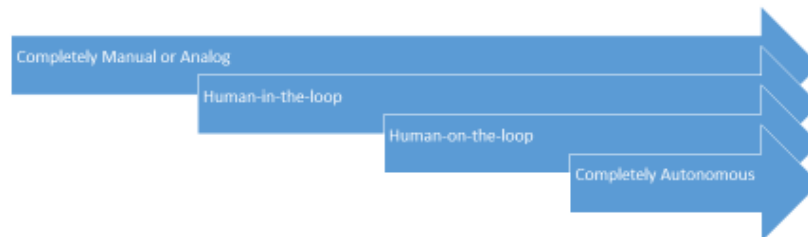
Figure 2: Relative Levels of Human Control in Autonomous Systems (Source: Accenture)

Processes and systems which would fall on the left side of the spectrum in the Figure 2 diagram require significant human input and decision making involvement. Processes which would fall on the right-hand side are cognitive or intelligent systems that are capable of making complex decisions on their own. These intelligent systems are built on complex algorithms and massive amounts of data in order to render seemingly complex decisions. Finally, full artificial intelligence that displays and acts on free will, is not a reality…yet. For a more in-depth view on this, with respect to DoD, please consult the Defense Science Board's (DSB) 2015 summer study on Autonomy. The study can be found by going to the DSB home page and looking in the Reports section at https://www.acq.osd.mil/dsb/index.htm.

Robotic Process Automation 101

To begin, how does industry define Robotic Process Automation (RPA)? The answer is there is no singular, industry-wide definition. We present three examples below, but note that even though they are worded differently, they are essentially saying similar things.

> *"…Use [of] a computer (aka robot) to manipulate existing application software (CRMs, ERPs, help desk and claim*

applications) in the same way that a person works with those systems and the presentation layer to perform a specific task."[1]

"…Provides organizations…with an agile digital workforce that follows rule-based business processes and interacts with the system in the same way that existing users currently do."[2]

"…a type of software that mimics the activity of a human being in carrying out a task within a process. It can do repetitive stuff more quickly, accurately, and tirelessly than humans, freeing them to do other tasks requiring human strengths such as emotional intelligence, reasoning, judgement, and interaction with the customer."[3]

The definitions above, and others like them, all share a common set of characteristics, noting **rules based processes, standardized and structured data, and deterministic, or singular, outputs**.[4] In practice, RPA is not dependent on new platforms or infrastructure[5] but works at the user interface layer, manipulating programs and databases exactly as a human would. The RPA software operates in the background while a user, previously busy with these rules based, structured tasks, is free to do work requiring higher levels of judgement, emotion, and creativity.

Example use cases for RPA include:

- Moving routine data between personnel and pay systems
- Moving data from one IT system to another
- Repeatedly manipulating email
- Large quantities of standard data entry
- Copy-and-pasting in large quantities
- Excel manipulation in large quantities
- Any interaction between the user interfaces of existing applications
- Large scale web scraping

[1] https://www.uipath.com/automate/robotic-process-automation
[2] https://www.blueprism.com/whatwedo
[3] Leslie Wilcocks & McKinsey Digital
[4] Leslie Wilcocks & Mary Lacity MIT Sloan Management Review Article
[5] (Walker, 2016)

Unsuitable use cases generally involve processes that require large amounts of judgement, emotion, or creativity, and large amounts of unstructured data.

RPA is generally implemented in a linear way. As we stated earlier, an organizations data must be digitized first. Without this, *there is nothing to automate*!

First, an organization's business processes must be rationalized and "mapped." This is arguably the most important, and the most difficult, step of the process. Mapping is typically done in a combination of ways, ranging from third person observation, to desktop recorders, to self-reporting. For example, some organizations use a Microsoft Visio-like tool to map the processes while a tool like Webex observes and records detailed desktop procedures. The Task Group found that very few companies have good process maps, and only discover them in detail when they audit their own processes to prepare for RPA pilots or proofs of concept.

An industry best practice in mapping balances what is **supposed** to be done, reflected, for example, in the company's official "business rules," with what is **actually** being done. Differences between what is supposed to be done and what is actually being done are brought to company leadership to arbitrate differences and approve the optimal process they want.

Mapping must also take into account the disaggregation and nesting of processes, or micro processes within macro ones, and significant processes or events up-and-downstream from the target process. Finally, mapping identifies all the IT systems that support the end-to-end processes.

The second major step is the identification of tasks that are suitable for automation. Some metrics used to determine task suitability include processes with high levels of human error, large volumes of manual transactions, and significant cross-system usage.

The third step is to determine the level of human intervention required or desired in a process, similar to the earlier discussion on levels of human interaction in autonomy. Desired human intervention is programmed into the "business logic" of the RPA. For example, if an automated task

exceeds the defined bounds of a certain programed "business rule," it is ejected for further human intervention.

An industry best practice is to allow a human operator or user to override any process at any time for any reason, at least initially. Each manual override is then analyzed for patterns in order to reprogram and improve the "bots" executing the RPA. Overtime, the ability for human users to override is taken away as the end-to-end process automation is optimized.

Lastly, the actual "bots" themselves (which are nothing more than servers deployed on a network or from the cloud) that deliver the RPA are put into action. They are typically monitored and controlled from a centralized command-and-control node, and are scaled up as the organization deems fit.

Beyond Robotics Process Automation

The value of RPA isn't just the benefits we described above. The automation of a process with RPA is enhanced when the data flowing through the process is analyzed. RPA, with data analytic tools like machine learning added, enables companies to gain greater insights from their data. The combination of RPA and machine learning is sometimes referred to as "cognitive automation."

Machine Learning 101

What exactly is machine learning? This term is used somewhat loosely in both industry and DoD. In essence, machine learning is the "creation of generalized systems that can perform analysis on new data."[6] Another way to view machine learning is that it is, quite simply, prediction technology.[7] Machine learning relies on analyzing vast amounts of data in order to develop probabilistic outputs.[8]

Models are at the core of machine learning. Models are all based on historical data, so they routinely need to be fed new data to be updated or rebuilt. But, the models that take an input and turn it into an output aren't

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[6] (Mannes, 2016)
[7] (Ajay Agrawal, 2016)
[8] (Zilis, 2016)

always understood, leading to a "black-box" problem.[9] This creates a problem when you want to test a model or want to maximize user trust of a model. In addition, questions of correlation versus causation in data sets is very difficult to determine. But, as machine learning becomes more ubiquitous, managers in companies will have to increasingly contend with how to manage them. In industry, the two most important resource requirements today are data and talent.[10]

In process automation, the analysis of data created from RPA implementation is then available to industrial and process engineers to improve the overall business through analytics. Data analytics help prediction capabilities of companies**.** An example is determining what to buy and when to buy it. Companies in the future will have to decide whether they trust machine intelligence for specific decisions or not.[11]

[9] (Mannes, 2016)
[10] (Ng, 2016)
[11] (Zilis, 2016)

Tab E - Appendix 2

Robotic Process Automation Outcomes

So why do companies pursue RPA? As the quote below describes, the benefits associated with "automation" are immense and diverse across an organization:

> *"RPA represents a pragmatic solution for addressing cost, growth, and performance objectives. In some cases, it can help companies defer major investments in IT modernization or new ERP suites, even as they reap the financial and operational benefits of automation. In other cases, CIOs can implement RPA in tandem with a larger transformation initiative, thereby allowing organizations to gain some immediate benefits. Software robots don't have to automate end-to-end processes to offer value. Even small investments in RPA can have a quick and significant payback."[12]*

There are three ways to "bin" the impacts of RPA – impacts on the organization, the employee, and the customer.

For the **organization**, the business processes themselves, regardless of what function they perform, typically see an increase in speed, accuracy, and volume of work. These changes typically result in budgetary savings. If the organization's data is of sufficient quality, then they can apply tools like machine learning to the RPA to gain deeper insights into its data and processes. If sufficient numbers of tasks are able to be automated, then the organization typically sees a decrease in full time equivalents (FTE). Finally, organizational outsourcing strategies are challenged as RPA may be cheaper than sourcing domestic or foreign labor.

As for the company leadership, CEOs can better monitor processes in the company as the more aspects of the business that can be measured, the better the organization can be managed. CIOs can leverage RPA as a bridging solution between modernization and recapitalization for large IT systems. CFOs can easily audit the business, and CMOs can effectively drive process efficiency.

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[12] (Walker, 2016)

For the **employee**, there is a reduction and elimination of dull, routine, and repetitive transactional tasks. Human rework done to fix errors earlier in a process is eliminated. Employees are able to focus on higher value work requiring "soft skills" like judgement, emotion, and creativity and their overall job satisfaction generally increases.

FTE reduction or elimination is typically only possible if the vast majority of an FTE's job consists of tasks that, individually and cumulatively, are highly likely to be automated. The more diversified the individual tasks that make up an FTE's job, the less likely the potential for the job to be totally eliminated. We will touch more on automation and labor later in this report.

For those employees who are impacted negatively by RPA, an industry best practice is to establish retraining programs to teach new skills to employees. Often, the funds for these programs come from budgetary savings generated by RPA implementation. However, to be of value, successful retraining requires employees to have an open mind and be willing to change and learn new skills.

For the **customer**, the task group only notes that there is generally a higher quality of service or product experience.

The following case studies illustrate the exact return on investment (ROI) achieved by a select group of companies.

RPA Example: Financial Services Company

Metric	Month 3	Month 8	Month 12
Head of RPA	1	1	1
Controllers	2	4	25
Client Developers	7	11	20
Partner Developers	26	100	57
Process Analysts	3	6	10
Processes	18	270+	400+
Bots	40	300	550

RPA Example: Financial Services Company #2

Metric	Month 3	Month 6	Month 16 (Forecast)
Head of RPA	1	1	1
Controllers	2	5	25
Client Developers	0	10	20
Partner Developers	26	170	170
Process Analysts	3	10	20
Processes	10	20+	260+
Bots	40	240	1255+

RPA Example: Financial Services Company #3

Metric	Month 6	Month 12	Month 18
Head of RPA	1	1	1
Controllers	2	2	3
Client Developers	7	25	40
Partner Developers	2	5	5
Process Analysts	3	4	5
Processes	2	60	100+
Bots	10	50	150

RPA Example: European Energy Company

Metric	Invoice Statement Generation	Emergency Contact Process	Missed Contract Renewals
Processing time	~20 min to few seconds	~25 min to ~3 min	N/A
Cost Avoidance	No longer had to hire additional 21 FTEs	No longer had to hire ~4 FTEs	N/A
Transaction volume	N/A	N/A	95% automated

Metric	First Year Impact
Processing Time	60% time savings (versus manual)
Cost Avoidance	~40 FTEs
Processes Automated	17
Productivity Increase	+8%

RPA Example: Various Sector Companies

Metric	International Business Process and Tech Services provider	International Telecom	UK Energy Supplier
Processes automated	14	15	60
Automated transactions per month	120,000	400,000-500,000	~1m
Bots	27	160+	300+
FTE replacement	N/A	100+	600+
Cost savings	30%	ROI 650-800%	200%

Figure 3: RPA Return on Investment Business Examples (Source: Blue Prism)

Tab E - Appendix 3

"The Elephant in the Room" – Automation and Jobs

      Various media outlets have produced articles and literature that have been propagating a "hype cycle" of reporting about the risks of people losing their jobs due to automation. Unfortunately, many of the articles are bleak and incite a lot of anxiety and emotion. This is not surprising since salacious headlines, like the ones below, are made to sell and, in turn, generate revenues.

"Is Your Job About to Disappear?"
-Bloomberg
https://www.bloomberg.com/graphics/2017-jobs-automation-risk/

"How Technology is Destroying Jobs"
-MIT Technology Review
https://www.technologyreview.com/s/515926/how-technology-is-destroying-jobs/

"The Bright Side of Job-Killing Automation"
-Fortune
http://fortune.com/2017/04/05/jobs-automation-artificial-intelligence-robotics/

"What Jobs Will the Robots Take?"
-Atlantic
https://www.theatlantic.com/business/archive/2014/01/what-jobs-will-the-robots-take/283239/

"Automation and Anxiety"
-Economist
http://www.economist.com/news/special-report/21700758-will-smarter-machines-cause-mass-unemployment-automation-and-anxiety

"US Facing Higher Job Losses to Robots, Automation: Study"
-Wall Street Journal
https://blogs.wsj.com/cio/2017/03/27/u-s-facing-higher-job-losses-to-robots-automation-study/

Figure 4: Example of Headlines on the Threat to Jobs from Automation (Sources: as shown)

      But what do we make of these headlines? Many organizations have attempted to quantify and qualify the impact that technology, particularly automation, will have on jobs. Let's consider some recent research.

Macro Perspective

OECD	McKinsey Global Institute	Deloitte Center for Government Insights	International Federation of Robotics	University of Oxford
http://www.oecd-ilibrary.org/social-issues-migration-health/	http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works	https://dupress.deloitte.com/dup-us-en/focus/cognitive-technologies/artificial-intelligence-government.html	https://ifr.org/img/office/IFR_The_Impact_of_Robots_on_Employment.pdf	http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf
"…On average, across the 21 OECD countries, 9% of jobs are automatable."	"…Less than 5% of all occupations can be automated entirely… ~60% of all occupations have at least 30% of constituent activities that could be automated."	Potential of between 96.7 million and 1.2 billion federal government hours annually saved.	"Robots substitute labor activities but do not replace jobs. Less than 10% of jobs are fully automatable."	"…47% of total US employment is in "high risk" category [for automation]…"
"…Automation and digitalization are unlikely to destroy large numbers of jobs. However, low qualified workers are likely to bear the brunt of the adjustment costs…"	"The right level of detail…to analyze the potential impact of automation is that of individual activities rather than entire occupations. Every occupation includes multiple types of activity, each [having] different requirements for automation."	"In the near term…large government job losses are unlikely. But cognitive technologies will change the nature of many jobs…freeing up to one quarter of many workers' time to focus on other activities."	"Automation has led overall to an increase in labor demand and positive impact on wages….The issue is how to enable middle-income earners in the lower-income range to upskill or retrain."	"…[Reduction in] aggregate demand for labor input in tasks that can be routinized by means of pattern recognition, while increasing the demand for labor performing tasks that are not susceptible to computerization."

Figure 5: Studies on the Effects of Automation on Jobs (Sources: as shown)

The most widely cited data comes from a 2013 study by two professors at the University of Oxford, Carl Frey and Michael Osborne.[13] In their analysis, they conclude that roughly "47% of total US employment is in the "high risk" category for [automation]." Their analysis is based on assumptions about what computers "are and will be suited to accomplish," and draws data from the Department of Labor's (DoL) O*Net database. It is unclear if this study is the most cited because of their conclusion concerning the population at risk for automation is among the highest the task group observed.

The McKinsey Global Institute (MGI) released a study in early 2017 with a similar purpose.[14] Their conclusion, again based on an analysis of DoL occupational data, was that "less than 5% of all occupations can be automated entirely…" Their analysis focused on "automation potential" and a breakdown of occupations into their composite tasks, a method of analysis that the Task Group strongly agrees with.

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[13] http://www.oxfordmartin.ox.ac.uk/mwg-internal/de5fs23hu73ds/progress?id=XW8_IuKzM1LV08UDNRSzSoWnCkWNIGfIGZ5N9rrm4q4,

[14] http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works

Results from different studies can vary dramatically on the potential for jobs to be automated. A study by PriceWaterhouseCooper (PwC) suggests that around 38% of jobs in the US "could potentially be at high risk of automation by the early 2030's."[15] While a different study by the Organization for Economic Cooperation and Development (OECD) reports that "on average, across the 21 OECD countries, 9% of jobs are automatable,"[16] and the International Federation of Robotics claims that "less than 10% of jobs are automatable."[17]

In the US federal government, the only attempt at quantifying any impact on jobs or productivity comes from Deloitte.[18] Through specific simulation parameters, they attempt to quantify not jobs, but productivity as a function of time and resulting monetary savings from labor reductions. The range of savings reported is between 96.7 million and 1.2 billion person-hours, and between $3.3 and $41.1 billion in salary savings. Again, this analysis is based on DoL's publicly available occupational data. Deloitte's analysis didn't breakout specific agencies or functions, including DoD. The task group didn't observe any attempt to quantify the impact of automation on the DoD.

From a market economy point of view, Goldman Sachs published a study in July 2016 that clearly outlined the economics associated with technology and jobs.[19] At the macro level, the economy as a whole benefits from changes brought on by technology. "Creative destruction," or the elimination of old jobs and the creation of new ones, is good for the whole but comes at the expense of massive individual disruption. The report identifies a natural 'arc' that occupations experience, from inception to transformation:

> "Occupations and industries follow a natural evolution. Early on, new job opportunities are plentiful and the work is often well-compensated. Over time, jobs become vulnerable to automation, outsourcing or falling wages (or some combination of the three). This process reflects the normal course of

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[15] http://www.pwc.co.uk/services/economics-policy/insights/uk-economic-outlook.html

[16] http://www.oecd-ilibrary.org/social-issues-migration-health/the-risk-of-automation-for-jobs-in-oecd-countries_5jlz9h56dvq7-en

[17] https://ifr.org/ifr-press-releases/news/position-paper

[18] https://dupress.deloitte.com/dup-us-en/focus/cognitive-technologies/artificial-intelligence-government-analysis.html

[19] http://www.goldmansachs.com/our-thinking/public-policy/narrowing-the-jobs-gap.html

economic demand, not any changes in policy. As automation becomes cost-effective, people's economic role shifts from 'doing' the work to 'organizing, coordinating and supervising' the increasingly complex resources and activities behind it. Today, the pace of this evolution is accelerating as measurement technologies and data-collection capabilities improve, putting more jobs at risk. However, at the same time, the individual experiences massive disruption within their own job."

The Goldman Sachs study found that the reduction in the price of a task increases its demand, resulting in subsequent increases in labor surrounding the task and process because of the spike in overall demand. The net result is not an increase in labor, but a demand for different skills and new occupations.

Micro Perspective

"If it takes less than one second of thought, then automate it."[20]- Andrew Ng

It is helpful to understand the conceptual linkages between processes, tasks, and occupations, and any resulting impacts from automation. Both occupations and processes are made up of many, many distinct tasks. We can dissect a "task" into its constituent components. These tasks involve specific data inputs and the analysis of that data to product predictions or insights. Each task also involves distinctly human inputs like judgement, emotion, and experience, and some sort of value optimization analysis. Both the specific data inputs and the human inputs are used to make a decision, which then generates an output for that specific task. It is important to note that DoD would recognize this model as analogous to the Observe, Orient, Decide, Act (OODA) loop taught to demonstrate decision making.

Machines and software are very good at repetitive, rules based, structured tasks, and are much better at it than humans. On the other hand, humans are, right now, the only entities that can apply judgement, emotion, experience, and the like. New technologies like machine learning are able to find new insights from data inputs that were previously

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[20] (Ng, 2016)

unattainable, required elevated human input, or were too expensive. A specific task can be automated if the task does **not** require uniquely human inputs or any associated value optimization.

An entire occupation is at risk for transformation or elimination if many of its constituent tasks can be automated. It is most helpful to think of automation as the optimization of tasks, rather than the outright elimination of FTEs, unless most of that FTE's tasks are at risk as well. The elimination of jobs is different than the elimination of tasks. Automating a task boils down to whether or not the discreet actions in a task can be defined well enough for a machine to exercise judgement.[21]

Conclusion

Historical examples show us that the total number of jobs ultimately increases, but specific jobs go away. The question is, will it be different this time? That is to be seen, but in the interim, if something like voting patterns are any indication, anxiety about automation and the future of jobs will still exist.

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[21] (Ajay Agrawal, 2016)

Tab E - Appendix 4

Automation's Impact on Labor within DoD

Approach

The task group wanted to understand what potential impact automation might have on DoD's workforce. We wanted to focus our attention on the business-centric support occupations within DoD. Unfortunately, we could not find data, studies, or analysis within DoD that measured productivity or individual work activities and tasks as a function of time; nor data, studies, or analysis that addressed the "automation potential" of military occupations through the lens of the occupation's individual component tasks.

The closest analog that we found outside of DoD was a 2016 study that attempted to quantify the impact that current automation technologies could have on a wide array of Department of Labor (DOL) defined occupations.[22] The study gathered much of its data from the DOL's Occupational Network (O*NET) On-line[23] database. Its general approach, including the calculation of time, productivity, and technical potential, is further explained in a technical annex. The Task Group agrees with the study's methodology and approach.

Within DoD, Defense Manpower Data Center (DMDC) is responsible for cross walking DoD military occupations to DOL Standard Occupational Classifications, primarily to assist transitioning veterans with their post-service employment search.[24] In the table that follows, the task group took a set of military back-office related occupations from the Army, Navy, and Air Force, cross-walked them in O*NET to determine their Standard Occupational Classification, and correlated them with the 2016 study's data visualization for automation potential.[25]

It is important for leaders to understand that the Task Group found that virtually no **occupation** is likely to be fully automatable now, or in the near future, but that there are significant **tasks** within a wide range of

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[22] http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works
[23] https://www.onetonline.org/
[24] https://www.onetonline.org/crosswalk/MOC/
[25] https://public.tableau.com/profile/mckinsey.analytics#!/vizhome/AutomationandUSjobs/Technicalpotentialforautomation

occupations that can be automated immediately using currently available technologies. With this understanding, it is clear numerous Army MOS's, Navy Ratings with associated NECs, and Air Force Specialty Codes related to business and support occupations possess a significant potential for automation. If this is the case then the nature of work for these Servicemen will likely change in the future. The changes may also affect the number of personnel needed to perform these tasks.

Army MOS	Navy Rating	Air Force AFSC	O*NET Occupation Title	O*NET Standard Occupation Classification	Automation Potential (Using Current Technology)
Paralegal Specialist	Legalman	Paralegal	Legal Secretaries	43-6012	78%
27D	LN	5J0X1	Paralegal and Legal Assistants	23-2011	69%
Pharmacy Specialist	Hospital Corpsman	Pharmacy	Pharmacy Aides	31-9095	70%
68Q	HM	4P0X1	Pharmacy Technicians	29-2052	62%
Cryptologic Linguist 35P	Cryptologic Linguist CTI	Cryptologic Language Analyst 1A8X1	Interpreters & Translators	27-3091.00	16%
Air Traffic Control Operator 15Q	Air Traffic Controller AC	Air Traffic Control 1C1X1	Air Traffic Controller	53-2021.00	52%
Chaplain Assistant	Religious Program Specialist	Chaplain Assistant	Mental Health Counselor	21-1014	26%
56M	RP	5R0X1	Marriage & Family Therapist	21-1013	13%
			Director Religious Activities & Ed.	21-2099	<5%
Patient Administration Specialist	Hospital Corpsman	Health Service Management	Medical Secretaries	43-6013	57%
68G	HM	4A0X1	Medical Record & Health Information Tech	29-2071	49%
Financial Management Technician	Personnel Specialist	Financial Management & Comptroller	Payroll & Timekeeping Clerk	43-3051	87%
36B	PS	6F0X1	Book Keeping, Auditing, and Accounting Clerk	43-3031	86%

Army MOS	Navy Rating	Air Force AFSC	O*NET Occupation Title	O*NET Standard Occupation Classification	Automation Potential (Using Current Technology)
Human Resources (HR) Specialist 42A	Personnel Specialist PS Navy Career Counselor NCC	Personnel 3S0X1	Executive Secretary & Executive Administrative Assistant HR Assistant, Except Payroll & Timekeeping Clerk HR Specialist	43-6011 43-4161 13-1071	59% 51% 22%
Automated Logistics Specialist/ Quartermaster 92A	Ship's Serviceman SH	Material Management 2S0X1	Stock Clerk: Stockroom, Warehouse & Storage Yard Bookkeeping, Accounting & Auditing Clerk	43-5081.03 43-3031	86% 86%
Transportation Management Coordinator 88N	Logistics Specialist LS	Traffic Management 2ST0X1	Shipping, Receiving & Traffic Clerk Cargo/Freight Agent Transport Management	43-5071 43-5011 11-3071.01	79% 69% 31%
Human Resources (HR) Specialist 42A	Logistics Specialist LS	Administration 3A1X1 Postal 8M000	Mail Sorters, Processors, & Mail Machine Operators Postal Service Clerks	43-5053 43-5051	80% 70%
Field Artillery Automated Tactical Data System Specialist* 13D	Aviation Maintenance Administrationman* AZ	Maintenance Management Analysis* 2R0X1	Data Entry Keyer	43-9021	86%

Figure 6: Military Occupations with Potential for Automation (Source: DBB study analysis compiled from multiple sources)

* These military occupations were listed as a significant level of tasks related to data entry.

Tab E - Appendix 5

DoD Findings and Observations – A Deeper Dive into the Impact of Automation

The Task Group attempted to baseline what was currently occurring within DoD regarding the automation of business processes. The intent of the group was to understand the impact new automation tools could have on the way DoD does business.

The Third Offset Strategy is where most of the efforts in DoD currently reside toward using new technology. This offset strategy is part of a long-term competitive strategy to harness our intellectual activity and sustain our strategic advantage. The Third Offset Strategy is under the umbrella of the Technology Offset Program and the warfighting realm is where most of these technologies are focused. As such, the Task Group did not attempt to map all the initiatives trying to apply automation to the application of force, or "kinetics." We simply noted that most of the resources and thinking going into automation technologies is focused on kinetic applications.

The application of automation under the strategy is generally driven by one or more of the following goals; automation to create a physical standoff, automation to relieve a physical burden, or automation to relieve a cognitive burden. Interestingly, none of these motivations or goals would translate to driving demand for automation in DoD's business operations.

The Task Group faced difficultly in trying to baseline automation as applied to business operations beyond kinetic applications. One major reason for the difficultly stemmed from the fact that definitions surrounding automation are unclear. This prevented communication through a common vernacular that everyone in DoD could understand. In addition, there is no clear definition of what the "back-office" consists of in DoD. "Business processes," which are defined by the DCMO, proved to be a better way of talking about the focus area. Another major reason for the difficulty in achieving a baseline is seemingly little to no incentive or mandate to track projects concerning automation and business processes. Even if there was, it would be very difficult to benchmark against industry, and any comparison would be incomplete and inconclusive. Finally, the Task Group observed that the limited understanding of the capabilities of new business

process automation tools prevented DoD from predicting future manpower implications.

Department of Defense Findings and Observations – Foundations

The Task Group wanted to understand if the foundations for automation tools existed in DoD to start, scale, and sustain projects in the future. The Task Group analyzed this through the same foundational framework that we applied earlier to Industry.

Processes

As shown in industry, successful automation of a process begins with a deep understanding of the process itself.

Processes in Abstract

DoD is very good at establishing processes that support kinetics. One example is "concepts of operations" (CONOP) which lay out processes by which military organizations apply force. Importantly, these CONOPs cannot be and are not so structured, standardized, and rigid that they prevent initiative, creativity, and flexibility in combat. DoD is acutely aware that the chaos and unpredictability of combat can't be forced into a linear "process" – this would be dangerous and impossible. Interestingly, one of the best attempts to quantify a "military process" was undertaken by the Marine Corps through the Ground Combat Element Integrated Task Force, and it produced usable data to drive decisions in how the Marine Corps structures its force.

The way DoD views business processes is somewhat lacking compared to how it views processes for applying force. Business processes typically occur in controlled environments, have defined inputs and outputs, and can have rules applied to them. As explained earlier, these characteristics lead business processes to be standardized and automated, unlike the processes DoD applies to force application. The art resides in striking the right balance between effectiveness and efficiency – between the standardization of processes that optimizes efficiently, and in the unstructured nature of creativity that optimizes innovation.

Business Enterprise Architecture

Business processes are generally captured in the Business Enterprise Architecture (BEA). The BEA was created to "help drive change in DoD, and track efficient delivery of people, processes, and products." It defines the "end-to-end" business processes that make up DoD. It is unclear if the BEA aligns with what DoD actually does, or how closely DoD follows the BEA.

The BEA is important to any process automation efforts that DoD could undertake for three main reasons. First, the BEA should be the template from which DoD streamlines, optimizes, and reengineers its business processes before the application of process automation tools. Second, BEA level four analysis, which details manual versus automated transactions, can give the precise location of the manual transactions to target for automation. Third, those same manual transactions indicate where human labor exists in a process, and can help define what the impact of automation will be on the labor that performs those transactions today. In other words, it can help DoD understand how its manpower, primarily transactional manpower, will change over time.

Today, however, the BEA seems to hold the most value in helping aid decisions about acquiring IT systems, not managing end-to-end processes. In this context, the BEA is used as a tool to search for similar systems in the architecture in order to limit redundant buying of similar systems. Anecdotal evidence suggests the BEA is not understood well, and therefore its use is limited and undervalued.

Process Management

Business processes that exist in DoD are derived from a mixture of statute, executive branch rules and regulations, and internal policies. Many of the processes or "business rules" are anecdotal and reside in people's heads at the local or tactical level. Enterprise management challenges are created if the organization wants to map major end-to-end processes down to the transactional level and a common standard for business rules is lacking.

It is unclear how much and how effective process efficiency tools like Lean Six Sigma, continuous process improvement, and process reengineering are across DoD. The Task Group did not look at the

effectiveness or use of these methods. Of note, the DCMO can only approve the obligation of funds for IT systems once the appropriate business process reengineering (BPR) has been completed.

Data

The Task Group explored how DoD treats and views data with the intent of understanding how those factors would impact new automation tools in DoD's business operations.

Initiatives

DoD puts most of its efforts toward the utilization of data is in the intelligence realm, particularly the processing of massive amounts of data generated by various sensor platforms. The area of auditability is the best example the task group observed on the use of data to make an enterprise impact in the realm of business operations. The Universe of Transactions (UoT) project, under the DCMO, CIO and Comptroller, has embraced a very innovative approach, is making real progress, and combines new tools with process reengineering to achieve audit readiness.

The Defense Logistics Agency (DLA) is an organization that leverages data. DLA's Enterprise Data warehouse looks to gather procurement data and gain new insights using advanced analytics. DLA has recently achieved some success in this area although it took them three to five years to identify and get the data. Inadequate communication across the organization was a key factor in the delay. DLA had attempted data efforts before, but to no avail and had faced sharp resistance within their organization to sharing data.

Demand for Data

The primary driver behind most of the data utilization efforts in DoD is a desire to achieve "better decision making." Anecdotally, however, the task group found several areas of concern. First, the demand for data to drive better decisions seems to be strongest at the senior leader level, but is weaker at the mid-management level. Second, some in DoD perceive data transparency and openness as a threat, since it eliminates a "lever of power" they have through either ownership of the data or the ability to shape conclusions from it. Third, some in DoD simply didn't value data over other decision making inputs like experience, judgement, or "gut."

These cumulative factors suggest the lack of a natural demand signal for data to drive decisions. This lack of demand may be an impediment to implementing automation tools in DoD.

Security and Control

Structural barriers deriving from DoD's organizational design, including stove-piped databases, restrict information sharing. In addition, some in DoD view the aggregation of data as a security concern. The disassociation of data, using this logic, creates a more secure information environment. Automation tools, however, rely on being able to readily manipulate accessible data**.**

Quality and Truth

Like industry, DoD is faced with issues regarding the "single point of truth" in its data. Responsibility for the management of the truth of the data in DoD is unclear, but agencies at each echelon in DoD often claim that they have the "authoritative" data. Because some business data in DoD is entered manually, the likelihood of error increases substantially, and further affects a single-point-of-truth and data "cleanliness." Errors in inputs are more likely in forward deployed areas that are experiencing higher operating tempo (OPTEMPO). Furthermore, weak common data definitions and standards makes unclear what data DoD actually wants to collect, and why.

Existence of Data

Perhaps more fundamental to business operations and the application of advanced automation is the difficulty DoD has in collecting data in the first place. In some areas, the absence of quality data over long periods of workers careers has created an inability among many to correctly diagnose that there is even a "data problem" to begin with. Fundamentally, if no data exists, or if its quality is poor, then there is nothing to analyze through automation in the first place.

Change Leadership

The Task Group wanted to understand how DoD solves problems and drives change. DoD's core mission is to fight and win the Nation's wars – this is the reason DoD exists. For that reason, business operations

are considered "non-core" missions that DoD must fulfill in the execution of its core mission. The ways DoD approaches problem solving in each of these areas have stark philosophical differences that must be understood in order to see how DoD may approach applying advanced automation tools to business operations.

Solving "Warfighting" Problems

In DoD, solving "warfighting" problems is "sexy" and is the reason most people join DoD to begin with. These problems are very much in the "comfort zone" of Departmental leadership, particularly uniformed leaders and "strategists" who are typically chosen to lead DoD. Military leaders go through rigorous training programs where they are actually taught how to both diagnose and solve these kinds of problems, and DoD promotes those who excel. DOTMLPF factors are considered and weighed to help shape a solution. For the application of force, factors like mass, objective, offense, security, economy of force, maneuver, unity of command, surprise, and simplicity (MOOSEMUSS) are considered.

In an economic context, the market forces that act on the DoD to solve these problems with significant resources and energy are the military threats posed by our enemies. DoD is willing to buy exquisite, specialized, and enormously expensive tools to help solve these kinds of problems. Generally, effectiveness is valued over efficiency, as the risk of failure is minimized through redundancy and capacity. These problems are extremely complex and the impacts of failure, depending on their scale, are significant.

Solving Business Process Problems

In general, the same problem solving tenants are often misapplied or misunderstood for business problems. First, business problems and solving them aren't "sexy" to leaders in DoD, and few people join DoD to work on world-class business problems. These problems are foreign and outside the comfort zone of most Departmental leaders and "strategists", particularly the uniformed leadership who, ironically, actually own most of the resources to affect change.

Military leaders are not taught how to diagnose or solve these problems. This can cause a philosophical difference about what constitutes a "problem" in the first place. The same DOTMLPF factors that

should be applied to these problems are often either inadequately applied or are forfeited altogether out of the hope that a technological solution will solve the problem.

In an economic context, the market forces acting on DoD to optimize the way it does business are non-existent. Generally, in business problems, effectiveness is also valued over efficiency. But, this skew, which is a judgement call, often leads to unnecessary duplicity, overlap, and redundancy in business processes that, by their very nature, have industry analogs that are optimized for efficiency. As the Task Group noted earlier, DoD is generally unwilling to spend resources on these problems and, like "warfighting" problems, business problems in DoD are extraordinarily complex. Most importantly, out of all of these differences, there is a missed opportunity to explicitly treat excellence in business operations as a "strategic enabler" that supports and enhances the "core mission" of DoD – fighting and winning the Nation's wars.

Change

Leaders in DoD, particularly military leaders, are very transient (military members move roughly every three years), so driving lasting change that stays beyond their tenure is difficult. It becomes very convenient for others to "wait out" the boss, and return to the status quo upon their departure.

Culture

DoD has a very strong culture, and any new initiatives, like the application of advanced automation tools, must understand how to navigate it.

Sense of Purpose

The vast majority of people that work in DoD do so because they want to voluntarily serve their country. Job satisfaction in DOD is derived not just from pay and benefits, but from a sense of helping the core mission of DoD. As such, most workers have a strong sense of self-worth and self-importance. Any business process automation efforts will have to address the unique nature and appeal of DoD work.

Risk

In general, the culture in DOD is very risk averse. This risk aversion is diversified among the spans and layers of DoD. In business operations, the status quo is valued because it is consistent, safe, and reliable. In general, the senior and lower levels of DoD are the most willing to take risks, but the middle layer is the most resistant. This lack of risk-taking, especially when it comes to business operations, drives a lack of imagination and innovative thinking.

Beliefs

When it comes to cultural beliefs about technology and humans, many leaders have an enduring belief that humans are better at tasks than machines. This may lead to a lower level of trust in automation tools, as well as decreased user acceptance of both the tools themselves and the data outputs.

Power Centers

As Retired Marine General Cartwright said, "People are the coin of the realm." Stature and relative power in DoD are derived from number of people you own and the size of your budget. Automation, and the potential to shed workers and save money, stands in stark contrast to this.

Technology

To understand how DoD may acquire an automation capability, the Task Group wanted to consider how DoD currently acquires other information technology (IT) capabilities and understand the foundations that make it possible.

IT Management

DoD has extensive experience in IT management, both good and bad, but unfortunately the memories and experiences of the failures have drawn the most attention. Two of the most prominent failures have been DIMHRS and ECCS, and, even today, people still highlight these two as examples of what not to do.

DoD has many different IT systems and they are managed through different "portfolios." Efforts toward consolidation of the multiple IT systems have traditionally been viewed as prohibitively expensive and complex. But, as we have seen in industry, RPA may be a convenient tool that may enable DoD to keep existing IT systems and manipulate data in each of them from "above."

One reason DoD has so many IT systems is that organizations, including the Office of the Secretary of Defense staff writ large, the Defense Agencies and Field Activities, and the Military Departments, all maintain and optimize business operations at their own respective levels, and therefore purchase IT tools that work against enterprise optimization. DoD's organizational design encourages stove piped data in these IT systems, preventing any enterprise analysis of data sets.

Another reason that DoD has so many IT systems is DoD has a philosophical tendency of thinking IT is a "magic wand" that will solve complex problems by itself. DoD often views acquiring state-of-the-art IT as an end-state unto itself, rather than focusing on the achievement of some business outcome via the use of an IT tool. The Task Group fears the pursuit of automation tools and new technologies themselves may be viewed incorrectly as another "silver bullet."

IT Acquisitions

DoD has a tendency to select a material (IT) solution before or in place of considering doctrine, organization, training, material, leadership, personnel and facilities (DOTMLPF) alternatives, which can be much harder to change or affect when faced with a business problem. The failure to consider other factors, or address root causes, can incur greater program costs in the long term and provide a suboptimal solution to Departmental business problems.

DoD is typically forced to choose a commercial-off-the-shelf (COTS) solutions first once the decision to pursue a material (IT) solution is made. The reason for this is the fact that Congress passed a mandate telling DoD to procure COTS solutions, vice solutions that were customized, in order to drive down costs in IT procurement. An unintended consequence is that this sometimes leads to acquiring business IT systems that do not fit the business processes for which they were acquired to support. This causes DoD's business processes to be modified so they "fit" inside the business

logic programmed into a COTS solution. It is unclear how COTS mandates would impact any purchase of advanced automation tools for DoD.

Process and business owners aren't traditionally in charge of the capability acquisition. This can lead to obscure requirements or ill-defined business end-states, as well as a temptation to "shed capabilities," and therefore reduce costs, if the program is at risk for being over budget. Integration costs can skyrocket, sometimes surpassing the cost of the software itself, as a result of ill-defined end states. The Task Group supports the addition of an addendum to DoD's acquisition regulations regarding the improved acquisition of business systems.[26]

DoD is generally unwilling to spend money on business systems compared to other acquisitions. This unwillingness to invest may hamper attempts to invest in automation capabilities, particularly in business operations. Interestingly, when Departmental leaders, over time, face "modernization" or "recapitalization" decision points related to the multiple IT systems, "automation" technologies like RPA may provide a bridging solution.

Finally, some acquisition and contracting officials are focused on getting the lowest price technically acceptable in the short term, without any regard for future savings that new automation tools may provide. It is unclear if DoD has a way to calculate the ROI on any new automation tools in order to justify investing and acquiring the tools in the first place. In addition, DoD does not confirm that efficiencies taken during program reviews were actually executed, which creates disincentives toward investing in automation that would achieve these savings in the first place.

Interface between Man and Machine

"Human Systems Integration" (HSI) is an academic discipline in DoD that is charged with helping to determine functional task allocation between man and machine. Unfortunately, it is unclear the extent to which HSI is used in DoD's IT systems, particularly business systems, and any metrics for success. There is no mandate for program managers (PM) to spend money on HSI, only a stipulation in the acquisition regulations stating that PMs should "plan" for it. As a result, HSI requirements sometimes become a "check-in-the-box." This deprives DoD from realizing any benefits that

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[26] https://dap.dau.mil/policy/Lists/Policy%20Documents/DispForm.aspx?ID=4656

task allocation between man and machine may have, especially in light of advanced automation tools.

People and Talent

Labor Costs

The greatest costs to DoD today are associated with labor. Roughly 75-80% of DoD expenditures are associated with labor. The amount of money spent in DoD on transactional labor, or the labor pool most susceptible to basic RPA, is unknown.

Strategic Workforce Planning

It is unclear if workforce plans exist that address the changes in talent needed for advanced automation tools in business operations. One initiative that attempted to posture DoD for future manpower requirements, the "Force of the Future," faced resistance because it was communicated primarily as a "handout to millennials" rather than as how the Department creates a future force that will fight future battles with future tools. In addition, efforts toward advanced "automation" in business operations may be resisted within DoD by people who view humans, in any system, as offering a degree of flexibility that is better than any automation tools.

Finally, DoD or Congress often simply establishes an arbitrary percentage of the workforce to cut, instead of rationalizing the underlying work and doing a true "troop-to-task" analysis when faced with manpower cuts. This inefficient method creates further sub-optimized business processes, and hurts DoD's ability to drive toward using advanced automation tools.

Allocation of Work

"Self-service" trends in DoD regarding the allocation of work has de facto defined whose time is more valuable in the organization. One example is the Defense Travel System, which took defense travel and the organizations that executed it, and placed it in the hands of the users. This shift, while convenient in some respects, shifted the actual work onto the service member, who is now burdened with another task to accomplish.

Education

As the Task Group noted earlier, workforce education regarding automation technologies in general was lacking.

Civilian Workforce

Significant union presence in some agencies has led to significant labor negotiations for IT solution implementation if the systems may eliminate manpower. This may have a serious impact on how automation is accepted in DoD.

New Talent

The Task Group observed that some agencies understand that they will need new skills in their workforce, but don't know how to acquire them outside of expensive service contracts. These contractors are viewed as the only way to get perishable or niche skills, like software engineers, data scientists, and MBAs, into DoD. The cost to recruit and retain these new, specialized skills is unknown, especially considering very high commercial demand for the same skills.

DoD is acutely aware that it lacks critical talent like software engineers and data scientists, and there are some efforts in the Services to cut down on this gap. For example, Army Cyber Command has charted a path for cyber soldiers to exist in the Army over the past few years. It remains unclear though if military "cyber" personnel will be tasked with tackling jobs within business operations. It is also unclear how DoD will compete with compensation offered in the private sector for this new talent.

Tab E - Appendix 6

Specifics on Recommendations and a Way Forward

The most useful way to think about how Robotic Process Automation (RPA) can be implemented in DoD is to describe a conceptual "how-to" guide. The task group modeled this "how-do" guide on industry best practices, and expert interviews in both industry and DoD.

Framework

The framework this "how-to" guide takes is by looking at the problem through "shape, start, scale, and sustain" lenses. The framework uses top-down direction and bottom-up incentives, and focus points on the six foundational elements: change leadership; processes; data; culture; technology; and people.
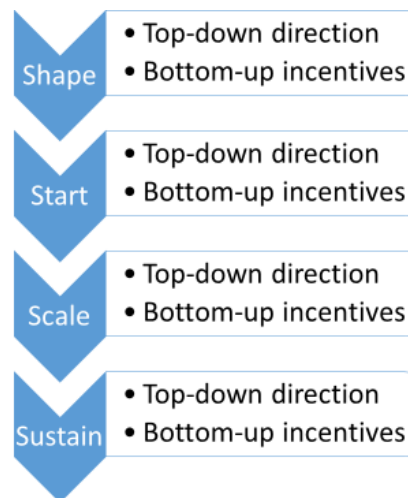

Figure 7: "How To" Guide for Implementing RPA in the DoD (Source: DBB study analysis)

Solving the Right Problem with the Right Tool

The Task Group wants to emphasize the importance of solving the right problem with the right technological tool. As stated earlier, the Task Group remains concerned that DoD will want to pursue new technologies like automation without fully understanding how they will help achieve a desired business end state or support DoD's core mission. A Silicon Valley venture capitalist shared that he "was concerned that DoD would spend enormous amounts of money on projects it didn't truly understand." Not all

problems DoD wants to solve require automation, but the ones that do can and should see significant benefits and Return on investment (ROI).

Proper root-cause analysis should be conducted in order to ensure that a tool like RPA is the right solution for a business problem. The new business capability acquisition policy should greatly enhance DoD's ability to do this. An organization should also identify the metrics they wish to use to measure and calculate ROI.

Shape Phase

There are four overall goals in the Shape phase. The four goals are: establish an initial demand signal for these new technologies; protect the interests of DoD from companies pitching this technology as a solution; create a working level of technological understanding to drive appropriate decision making; and minimize institutional resistance to this technology.

DoD should promulgate a strategic vision for how it wants automation to impact the business operations of DoD. This vision should emphasize the benefits automation provides through increases in quality, volume, error reduction, and speed. Doing this would show that the leadership endorses this idea and tool. This vision should also explicitly describe excellence in business operations as a "strategic enabler" that supports and enhances the "core mission" of DoD and mandatory for the successful execution of the technology offset program. This could succinctly be called "The Hidden Half of the Technology Offset Program" or the "Technology Offset for DoD Business Operations."

The Deputy Secretary should mandate business portfolio process reviews to identify automation opportunities as the enterprise and component levels. This should require all business functions to provide a plan on where automation can be applied, and, where appropriate, integrated with other functions. This should also include a mandate to enhance the Business Enterprise Architecture (BEA) into a tool that can be used for strategic business operations planning and enterprise wide process reengineering – a prerequisite for the application of process automation tools.

There are several other steps DoD should take. DoD should promulgate a standardized lexicon of terms associated with automation in its various applications. DoD should also develop a strategic

communication plan to talk about "automation" with its workforce in order to proactively dispel myths and also be forthcoming about the impacts of automation on jobs.

Education is very important to help drive understanding and create a natural demand signal in the Shape phase. Executive and mid-level managers should receive "Process Automation 101" briefings from subject matter experts. These briefings should include any promulgated standardized lexicon. The acquisition community must also be educated about advanced automation tools in order to understand how they may be able to incorporate them into their programs at their respective levels. In addition, process owners and those who help optimize processes, big and small, must be educated on how new automation tools can enhance the way they do their job at their level. Finally, the workforce writ large needs to have at least some education on automation tools to proactively dispel myths surrounding the technology. This can be most effectively done through the strategic messaging plan discussed earlier.

Start Phase

The overall goal of the Start Phase is to demonstrate the value of RPA through pilots and demonstrations, grow the natural demand signal for the technology, establish the foundations for scaling the capability organically, and establish the structure and resources needed to start. DoD should identify suitable pilots using the same criteria used by the private sector mentioned earlier. **TABs G** and **H** have proposed pilots and or demonstrations provided to the Task Group by the Defense Logistics Agency (DLA) and the Office of the Deputy Secretary of the Navy for Management (DUSN(M)).

In the Start phase, DoD will have to make a capability acquisition decision of either build, buy, or a hybrid. The Task Group recommends "outsourcing to insource", or a hybrid approach in order to maximize speed. DoD should initially outsource the capability to a private sector company, then, as the proofs of concept and demonstrations scale and expand, transform the organization by growing the capability organically and eventually eliminate the outsourcing.

Initial resourcing will be required, but funding will likely not be available or present to obligate toward pilots or demonstrations. Ideally, top-down funding will be provided. Organizations must work to incentivize

resource holders by stipulating that their initial investment in RPA, which yields savings, can later be captured by that PM in the event top-down funding is not available.

Targeted processes should be referenced in the BEA. Process mapping down to Level Four must be done in order to understand what manual transactions or tasks may be candidates for automation. In addition, an analysis of these transactions must take into account the type of data standards required at the enterprise level. This will ensure scalability, enterprise analytics, and system interoperability.

Scale Phase

Governance and management will become more important as automation efforts start to grow in the Scale Phase. The CMO, CIO, and process owners should initially be on an integrated management team to oversee planning and execution of automation projects. This capability should transition into a center of excellence that will retain the authorities to drive change and redefine processes over time. The goals for the scale phase are to have a fully functioning center of excellence and to demonstrate pilots across various business processes.

Importantly, any future governance and management will need the alignment of resources, authorities, and accountability in order to be effective. A model for the Department to consider is the now defunct Business Transformation Agency (BTA). The Task Group views the BTA model as extremely attractive and a framework for any automation execution efforts at the enterprise level.

The Department will need to fundamentally rethink how it manages processes versus programs as scaling occurs. The Department is optimized to acquire "things," and as such has a tremendous bureaucracy to plan and execute management of these programs. Unfortunately, the Department often outsources this to a third party or delivers sub-optimized services through sub-optimized management when it comes to managing the delivery of a service or an end-to-end business process. The Department should consider how to better manage end-to-end processes. Business portfolio management concepts being considered by AT&L are a great start.

The initial execution team will likely consist of contractors, but over time they should be replaced by organic labor supplied by the Department. This will allow the Department to be self-sufficient and build talent capacity in this area over time and reduce the reliance on third party contractors. The task group recommends looking at the Universe of Transactions (UoT) team organization, structure, and operating concept to scale and model an implementation arm upon.

Finally, scaling opportunities will need to be matched with top town direction and bottom up incentives. Flexible and responsive resource allocation is required to rapidly build this capability out, and efficiently address areas of maximum impact. The Department should recognize the importance of failing fast, doing demonstrations, gaining user acceptance, focusing on quick wins, rapidly reengineering processes, and incentivizing identification of local opportunities for automation.

Sustain Phase

Automation efforts will need to be continuous in the Sustain Phase. Opportunities will expand and change as the technology itself changes and becomes, presumably, more capable. The Department needs to be postured to exploit the opportunities to automate systems when the chance is presented.

A long term talent acquisition strategy is essential for sustaining any center of excellence and maximizing ROI. This is the bedrock for the creation of a DoD business culture dedicated to continuous process improvement as well as innovation. The center of excellence should be modeled after the best FFRDCs and should attract the best business and technology talent from across the country. The value proposition for incoming talent should be, and currently is, the ability to tackle some of the most unique and complex business problems in the country at one of the largest organizations in the world. These unique public sector business opportunities are not currently advertised for many reasons. The focus on acquiring talent to help kinetic problems facing the department is one primary reason.

Defense Business Board

TAB F

Citations, Legislation, and

Directives

Citations, Legislation, and Directives on Reform and Workforce Reduction

Citation/Legislation/Directive	Outcome Expectations	Citation/Legislation/ Directive Timing
FY17 NDAA Title IX	Tasks SECDEF to conduct a thorough review of how the DoD conducts business operations with focus on how to become more effecitve and efficient	FY2019
FY16 NDAA Section 217	Establish parameters to start administering grants and S&T money for Defense Business Systems	25-Nov-15
FY16 NDAA Section 218	Requires SECDEF to establish "technology offset" program	25-Nov-15
FY16 NDAA Section 883	Revises Sec 2222 Business systems must be integrated into business enterprise architectureand be auditable Establishes requirement for Business Enterprise Architecture (BEA) by DCMO BEA will be integrated into IT enterprise architecture Establishes Defense Business Council (DBC) to advise SECDEF on developing BEA, conduction business process reengineering, and developing system requirments	25-Nov-15
FY12 NDAA Section 901	Appropriated and nonappropriated funds may not be obligated to defense business systems during future years defense plan until "pre-certification authority" (PCA) determines proper business process reengineering has been undertaken	31-Dec-11
FY10 NDAA Section 1072	Defense Business System modernizations may not be certified to obligate funds in excess of $1 miliion without a determination of whether or not business process reengineering haas been completed	28-Oct-09
OMB-17-22	Directs development of comprehensive plan for reforming the Federal government and reducing the Federal civilian workforce	FY2019
SECDEF Memo - 17 Feb 2017	Directs establishment of Cross-Functional Teams to address improved mission effectiveness and efficiencies in the DoD in the areas of human resource management, financial management, real property management, acquisition and contract management, logistics and supply chain management, healthcare management, base services, and cyber and information technology management	FY2019
CJCSI 5124.01	Establishes Knowledge Management Cross-Functional Team to focus on sharing information and knowledge management best practices and lessons learned across the DoD	
DON CIO Memo - 7 Mar 2014	Publishes DON Knowledge Management Strategy to create, capture, share, and resue knowledge to enable effective and agile decision-making, increase the efficiency of task accomplishment, and improve mission effectiveness	
DoD Instruction 5000.xd Business System Requirements & Acquisition Draft	Aligns commercial best practices and minimizes customization Focuses on identifying the business problem and business endstate first, then applying an IT soultion	Incorporates & Cancels Enclosure 12 of DODI 5000.02 - 7-Jan-2015
DoD Instruction 8115.01 IT Portfolio Management	IT investments managed as portfolios	10-Oct-05
DCMO End-to-End (E2E) Business Process Integration Framework	Serves as the foundation for business process reengineering Basis of audit readiness and financial compliance Drives alignment toward goals of IT portfolio management policy Provides holistic picture of how IT investments are mapped to capabilities Assigns each of the 15 processes a relevent Undersecretary to "mature" to certain levels of specificity DoD agencies and Services responsible for further specificity to include down to the "manual versus automated activities with the defense business systems	17-May-13
DCMO Business Process Reengineering Guide	Detailed guidance for conducting BPR "Standard Guide" for defining business problem to be solved, looking to process, and coming to a solution with or without IT	28-Sep-12
DoD Unmanned Systems Integration Roadmap FY13-38	Focused on physical end item in air, sea, undersea, ground domains Does NOT address significant issues with "backoffice"	28-Sep-12

Citations, Legislation, and Directives on Reform and Workforce Reduction

Citation/Legislation/Directive	Outcome Expectations	Citation/Legislation/ Directive Timing
Defense Acquisition Handbook 6.3. Human System Integration	Dictates that "When assessing manpower (for a program), system designers shuld look at labor intensive tasks…based on a top-down functional analysis, an assessment should be conducted to determine which functions should be automated, eliminated, consolidated, or simplified to keep manpower numbers within constraints"	Supports DoD Directive 5000.01 20-Nov-2007
Joint Concept for Robotics and Autonomous Systems	Precept #3 "Interconnected human-RAS teams will automate many logistics functions, from warehouses management to transportation to sustaining a forward operating base, improving the tooth-to-tail ratio and efficiency "Use of big data analytics, visualization techniques, and automated collection management will result in more informed, quicker decisions…" Concept Required Capabilities (CRC) include prevention of hacking and spoofing, EMP hardening, operation with degraded systems, redundancy and fail safes…	19-Oct-16
Defense Innovation Board Recommendations to SECDEF - 9 Jan 2017	DIB recommendations to the SECDEF on innovative means to address future challenges through the prism of three focus areas: people and culture, technology and capabilities, and practices and operations	

Defense Business Board

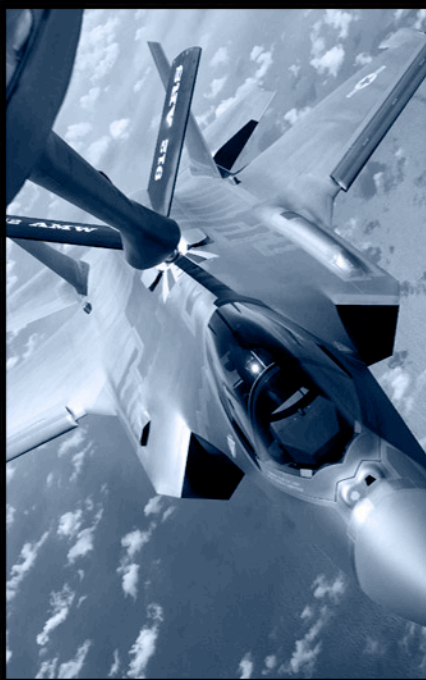# TAB G

DEFENSE LOGISTICS AGENCY

AUTOMATION PILOT PROGRAMS

DBB RFI

- The DBB has requested DLA provide a list of automation pilot programs to them in order to potentially recommend those programs to the SECDEF to be pursued DoD-wide and "…to advocate [on DLA's behalf] as a DoD entity that is doing great work and making strides in this area."

DLA RFI Response

Program Name:	Distribution Modernization Program
Functional area:	Supply Chain Operations
Anticipated Improvement:	Gain significant efficiencies by automating and modernizing DLA storage and distribution functions to improve operations.

Program Name:	DLA J6 Migration/Release Strategy
Functional area:	Information Systems
Anticipated Improvement:	Developing a solution to automate code migration between environments.

Program Name:	DLA Database/Environment Statistics
Functional area:	Information Systems
Anticipated Improvement:	Coordinating with the DISA Team to determine what (if any) monitoring tools are available to access system data to alert of possible issues before they occur.

Program Name:	DLA Portfolio and Architecture Tool Suite (DPATS)
Functional area:	Enterprise Architecture/Information Systems
Anticipated Improvement:	Reduction in time associated with response to IT-related data calls, requirements analysis, and assessments by deploying the DLA Portfolio and Architecture Tool Suite (DPATS); DPATS automates visualization of relationships between DLA's enterprise architecture, business processes and capabilities, and business systems; Uses commercial software to integrate enterprise architecture and business system portfolio management, linking business processes and process controls to systems and architecture to enable identification and control of indirect effects of system changes on business process controls.

Program Name:	Enterprise Data Analytics
Functional area:	Information Systems, Finance, Procurement, Logistics, and Supply
Anticipated Improvement:	Quick start project for an Enterprise Pricing Capability bridging Web delivery and EDW data, J6 and J7 working Agile development effort in a collaborative fashion Leaning Forward - Leveraging planned Enterprise Business System (EBS) Focused Business Solution upgrade to allow for Modern Web design for EProcurement SAP "Personas" use cases to Tailor Screen Layout with Integration of SAP Portal " Fiori" Framework to allow for usability enhancements.

DLA RFI Response

Program Name:	Enterprise Data Warehouse
Functional area:	Information Systems, Finance, Procurement, Logistics, and Supply
Anticipated Improvement:	Implementation of Visual Analytic Tools, Enterprise Analytical toolsets, Enterprise Data Dictionary to allow analyst community access to Enterprise level data as single source of truth Enterprise toolsets, data governance, and modern data storage capabilities to increase accuracy and velocity of data analysis

Program Name:	DLA CIO Dashboard
Functional area:	All functional areas
Anticipated Improvement:	The Dashboard provides a single point of access to see information from multiple systems monitoring DLA J6 applications and infrastructure.

Program Name:	Document Automation: DLA Multi-Function Device (MFD) Service
Functional area:	Information Systems
Anticipated Improvement:	DLA used this MFD service internally with an estimated annual savings of $5.7M. The Department of Navy has projected an estimated $36.6M per year savings by using this service. If we applied DoD-wide, it is estimated that an additional annual savings of more than $195.9M per year could be achieved for DoD.

Program Name:	Document Automation: Maps on Demand Service
Functional area:	Information Systems
Anticipated Improvement:	NGA/DLA Maps on Demand process has reduced print times from five to nine weeks to days in most cases, with 80 percent of all print missions now leveraging Maps on Demand. The team's effort cut the volume of print and replication needed to meet DoD requirements by 50 percent, and saved the DoD and taxpayers $10M annually. The NGA and DLA earned the National Intelligence Meritorious Unit Citation in recognition of outstanding service in April 2015. Continuing support includes 1) a joint Hybrid Map Support Office (MSO) at Ft Bragg where DLA Distribution, Aviation and Information Operations work in the same facility to ensure that shelf stock and on-demand are in perfect complement, and 2) remote map databases that allow for Contingency and Replication on Demand for digital map products.

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DLA RFI Response

Program Name:	Document Automation: DACS - Document Automation Content Services (DACS) in support of the Defense Technical Information Center (DTIC)
Functional area:	Information Systems
Anticipated Improvement:	The DACS service is offered by DLA to DoD customers. DACS allows customers to take advantage of powerful workflow and records management compliant repository services - which they would not otherwise be able to afford. The customer pays only for the portion of the DACS capability that they use and they retain any associated cost savings. DACS is a standing COTS capability - and DLA configures "libraries" for customers quickly and economically.

Program Name:	Single Point of Entry (SPOE)
Functional area:	Information Systems
Anticipated Improvement:	Automates the processing of customer requirements, giving DLA Information Operations customers a single portal for providing capability requirements. Workflow automated to integrate the processes for Requests for Change (RFC), IT Capability Requests, and IT Service Requests using BMC's MyIT with a context-aware interface and an enhanced user experience.

Program Name:	EAGLE
Functional area:	Personnel system
Anticipated Improvement:	Ongoing improvements include Leave Request Mobile application, Telework Management, and EAGLE Enterprise Change Request Tool (ECRT).

Program Name:	Learning Management System (LMS)
Functional area:	Personnel system
Anticipated Improvement:	Migrating current LMS capabilities to a commercial cloud-based application; Includes automation of talent management processes e.g. (Competencies, Goal and Career, Individual Development Plan), automated tracking process for annual PII and CyberChallenge training and automated notifications of pending due dates.

Program Name:	Governance, Risk, and Compliance - Risk Management
Functional area:	Information system
Anticipated Improvement:	Provides an enterprise tool to manage the agency's governance, risk and compliance activities.

DLA RFI Response

Program Name:	FLIS / Cataloging
Functional area:	Logistics information systems
Anticipated Improvement:	A guided Turbo Tax like system for Log Info Svcs could yield time savings through automation by reducing manual characteristics input by 20%. A configurable business rule engine would allow Log Info Svcs to reduce a tremendous amount of maintenance processing. This could result in eliminating manual processing of 70% of the following maintenance requests: Supply Support Requests, Army Maintenance, DLA maintenance, Navy, and Air Force Maintenance. 135,498 maintenance transactions were processed in 2016. Today, Log Info Svcs has 11 full time catalogers performing collaboration functions. A collaboration tool would result in a significant reduction in manual workload allowing this staff to be repurposed to other mission sets.

Program Name:	Retirement Estimate Request System (RERS)
Functional area:	Personnel system
Anticipated Improvement:	Automates paper process to allow employees to complete online retirement estimate form. Automated workflow allows Human Resources personnel to manage workload and view overall trends.

Program Name:	Automate Intermediate Document (IDOC)
Functional area:	Information Systems
Anticipated Improvement:	Review trends to interface failures and complete system changes to alleviate manual correction workload.

Program Name:	Enterprise Business Systems Planning Automation
Functional area:	Information Systems
Anticipated Improvement:	Develop an alternative planning approach to the current requirements gathering, design/build/test, etc., process which allows for quick delivery of essential functionality, enables rapid reprioritization and allows for more efficient resource allocation.

Program Name:	Enterprise Business Systems Planning Automation (Disposals)
Functional area:	Information Systems
Anticipated Improvement:	Automate disposal processes to reduce workload, increase productivity, better manage disposals, and ensure OSD Reporting and Policy Requirements are met.

DLA RFI Response

Program Name:	Enterprise Business Systems Planning Automation (Over-Procurement)
Functional area:	Information Systems
Anticipated Improvement:	Automation resolved issues with over-procurement calculations to reduce planner workload.

Program Name:	Enterprise Business Systems Planning Automation (Returns)
Functional area:	Information Systems
Anticipated Improvement:	Automation of the Material Returns program logic in EBS SAP to reduce Planner workload.

Program Name:	Enterprise Business Systems Planning Automation (Recoupment)
Functional area:	Information Systems
Anticipated Improvement:	Automation of the Recoupment process to reduce Planner workload.

Defense Business Board

TAB H

OFFICE OF THE DEPUTY UNDER

SECRETARY OF THE NAVY (MANAGEMENT)

AUTOMATION PILOT PROGRAMS

Defense Business Board (DBB) Automation Study
Office of the Deputy Under Secretary of the Navy (Management) (DUSN (M))
Potential Pilot Submissions

Process Improvements (Automation)		
ORG	**INITIATIVE**	**STATUS**
M&RA	Approving Medical Bill Waivers	Conceptual
DON AA	Financial Management Transactional Processing	Conceptual
DONAA	Automation of triannual reconciliation between HR and Payroll Authoritative Data Sources	Currently Underway
NCIS	SendWord Now -- Consolidated/automated Emergency Communication process	Conceptual
NCIS	Evidence Collection Manager X (modified GOTS automating crime scene search collection)	Currently Underway
NCIS	Billet Backfill Request Management - Automated Workflow	Currently Underway
ONR	Patent & Trademark Automated Collections	Currently Underway
General	Improved ability to plan for or operationalize potential surge (e.g. increased ship building demand, commanded reductions in overall energy usage, or increased reliance on unmanned warfighting technology)	Conceptual
General	Digitization (Scanners / Scanning Documents)	Conceptual
General (FM)	Feeder system reconciliation / auditing transactions between systems	Conceptual
General	Internet of Things as a means to monitor and identify areas of concern (e.g. sensors on sanitation trucks to identify pot holes in the city, sensors on clothing to monitor vital signs)	Conceptual
General	Unmanned systems for high-risk tasks (e.g. underwater demolition, nuclear reactor meltdown containment / cleanup)	Conceptual

Process Improvements (Centers of Excellence)		
ORG	**INITIATIVE**	**STATUS**
M&RA	Incentive/Special Pay Package Approvals	Conceptual
DON AA	Consolidated Employment Information Center	Conceptual
DON AA	OCHR HQ Initiative for Injury Compensation Consolidation	Currently Underway
DCMO	Defense Business System (DBS) Organizational Execution Plan (OEP) Process Automation	Conceptual

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