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Enlisted Detailing Market Place Analysis and Pilot

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NPS NRP Executive Summary
Enlisted Detailing Marketplace Analysis
Report Date: 12/31/2019 Project Number (IREF ID): NPS-19-N322-A
Naval Postgraduate School, Graduate School of Defense Management

NAVAL RESEARCH PROGRAM
NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

ENLISTED DETAILING MARKETPLACE ANALYSIS

Period of Performance: 10/01/2018–12/31/2019

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EXECUTIVE SUMMARY

Project Summary
The Naval Postgraduate School has conducted extensive research on the enlisted assignment and retention processes within the Navy and across the other services. Research in 2018 updated earlier work on the enlisted assignment and retention processes, including two-sided matching, optimization and the Navy's current auction-based Assignment Incentive Pay program, and developed market-based courses of action (COAs). Implementing these COAs requires collecting, consolidating, mining, and protecting the data needed to implement the detailing marketplace, potentially leveraging machine learning (ML) platforms against manpower data sets, and encoding sailor record data using "blockchain" structure.

The command's value will likely be algorithm-driven, and based on billet requirements compared to sailor training records, performance data, and demographic data. This research effort will examine algorithmic approaches to combining diverse data elements into a single metric by which commands can rank sailors. In addition, to reduce the total cost of voluntarily placing the right sailor in the right billet, this research will examine how concepts from behavioral economics might nudge sailors to accept hard to fill billets, including offering personalized combinations of non-monetary incentives.

Our research shows the following: ML algorithms can predict future outcomes by finding statistical patterns in the data unobservable to humans, and help develop a fitness score for each worker-job pair; blockchain technology can provide a secure, reliable, and efficient way to distribute sensitive data, while controlling whom, where, when, and how the data are accessed; the multiple-criteria decision-making literature contains dozens of methods to aggregate individual performance and billet data to rank equivalent classes of sailors for billet-fitness, but none of these methods are well validated; and behavioral economics and non-monetary incentives can nudge sailors to accept hard-to-fill billets

Keywords: *enlisted detailing, enlisted assignment, retention marketplace, market-based compensation*

Background
The Navy needs a market-based process that is capable of meeting the Navy's job, career, and quality needs, while also meeting the desires, preferences, and aspirations of individual sailors. A more market-based process would provide flexible incentives and negotiation between sailors and commands, while creating a more voluntary system. Specifically, sailor/command negotiation in the marketplace would provide more opportunities for sailors and commands to directly or indirectly work out terms and conditions for billet assignments and enlistment contracts. It is crucial to provide flexible incentives so that commands and sailors can negotiate a wide range of monetary and non-monetary incentives as part of the assignment "package" to ensure the most qualified sailors fill all jobs.

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The FY2018 research proposed alternative COAs to introduce market-based mechanisms into the enlisted assignment and retention process, specifically auctions, two-sided matching, and two-sided matching with money. Auctions are best suited to address retention issues, and the basic auction can be modified to incorporate adjustments for quality sailor performance, individualized non-monetary incentives, or both. However, auctions cannot effectively address the one-to-one assignment process required in the enlisted detailing marketplace.

In addition, two-sided matching is specifically designed to address the assignment problem, but it does not address retention or ensure that all billets will be filled, particularly hard-to-fill priority billets. However, two-sided matching with money addresses both assignment and retention problems, and therefore best fits Navy requirements for an enlisted detailing marketplace.

Findings and Conclusions

Our current research shows that the Navy's enlisted assignment and retention market process can be improved by using a combination of ML, blockchain technology, multi-criteria decision-making methods, and behavioral economics. ML algorithms predict future outcomes by finding statistical patterns in the data unobservable to humans. In a detailing market with sailors effectively bidding for jobs and commands choosing whether or not to accept them, ML can help develop a fitness score for each worker-job pair, allowing sailors and commands to more correctly rank-order jobs based on the job fit for both. Blockchain technology provides the necessary security to protect sensitive personal information with a decentralized system. Network administrators using blockchain to support a private, permissioned, and authority drive architecture, can control who, where, when, and how the blockchain is accessed without a third-party verification system.

Additionally, current qualification and certification data can be used in combination with simple, non-compensatory multi-criteria decision-making methods to rank sailors into equivalence classes. However, the relationship between qualification and certification data and performance is not strong enough at this point, nor are those data sufficiently fine grained, to accomplish individual sailor ranking, but assignment algorithms can be built to develop the equivalence-class rankings. The Navy should choose among multi-criteria decision-making methods with smaller data requirements. For example, Technique for Order of Preference by Similarity to Ideal Solution and Complex Proportional Assessment of Alternatives appear to be good candidates. There are also several well-validated individual difference variables that predict performance, and those can be aggregated with billet data to rank individual sailor-billet fitness (e.g., Armed Services Vocational Aptitude Battery scores available from recruitment data).

Behavioral economics can also help nudge sailors to accept hard-to-fill billets (e.g., informing sailors about their fit for open billets should help correlate command and sailor preferences, improving the assignment across all COAs). Furthermore, individualized packages of non-monetary incentives can induce sailors to volunteer for hard-to-fill billets.

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Recommendations for Further Research

Our research results can be extended in several ways. For example, comparing ML output versus traditional modeling, possibly targeting a specific career field, would determine correlation or disparity between the two modeling approaches. This would identify the value of ML beyond or in complementing traditional models. It would also be beneficial to conduct a cost-benefit analysis to determine if blockchain benefits outweigh the high expected implementation costs, and determine the best approach to creating the blockchain architecture: developed in house, outsourced to a defense department agency, or outsourced to a commercial provider. Further, ratio-scaled individual difference performance predictors exist and can be used by the Navy to rank individual sailors; the two best-validated measures, general intelligence and conscientiousness, should be available to the Navy from the recruitment process. Therefore, the Navy should verify the availability of ratio-scaled predictors, and then evaluate multi-criteria decision analysis methods, as currently, none are well-validated. Based on very limited evidence, Technique for Order of Preference by Similarity to Ideal Solution and Complex Proportional Assessment of Alternatives appear promising. Lastly, future research could involve a survey of commercial behavioral economics approaches to employee retention and job assignment applications. This data could help integrate additional behavioral economics approaches into the Navy's marketplace detailing model, including integrating monetary and non-monetary incentives, which would then reduce forced billet assignments.

Acronyms

Course of Action	COA
Machine Learning	ML