

Readiness Based Sparing: A Research Summary

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1. Research Purpose

We believe that Readiness Based Sparing (RBS) is the superior method of sparing, far more efficient, cost-effective, and comprehensive than its predecessors, and that it should be utilized across the U.S. Department of Defense. Unfortunately, Department of Defense and Air Force policy is currently rather ambiguous concerning its use, and we plan to make a case to those individuals involved in policy-making to update the wording of such policy to more plainly mandate the use of RBS methods. In the interest of more thoroughly investigating this belief and, if it is confirmed, building a body of supporting evidence, we performed a measure of scholarly research on the topic, which we shall proceed to summarize in this paper.

2. Data

We have compiled a collection of forty papers dealing in some way with the process of Readiness Based Sparing. These were gathered by making online search queries for “readiness based sparing,” first without, then with the quotation marks, on both the Defense Technical Information Center’s website and Google’s Scholarly Articles search. Relevant data and summaries for each of these papers were recorded into a small database using Microsoft Excel. The following is a summary of the findings of this research.

3. Categories

These forty papers can be categorized several ways; four described below are by sponsoring organization, date, branch of military concerned, and general stance on RBS.

3.1. Sponsoring Organization

These papers came from eleven different organizations: the Naval Postgraduate School, the Center for Naval Analyses, the Logistics Management Institute, the Naval Engineers Journal, the Air Force Institute of Technology, the Navy Fleet Material Support Office, Clockwork Solutions, the United States General Accounting Office, the Naval Air Systems Command, the Office of the Under Secretary of Defense for Research and Engineering, and the RAND Corporation. Below is the breakout of papers among these.

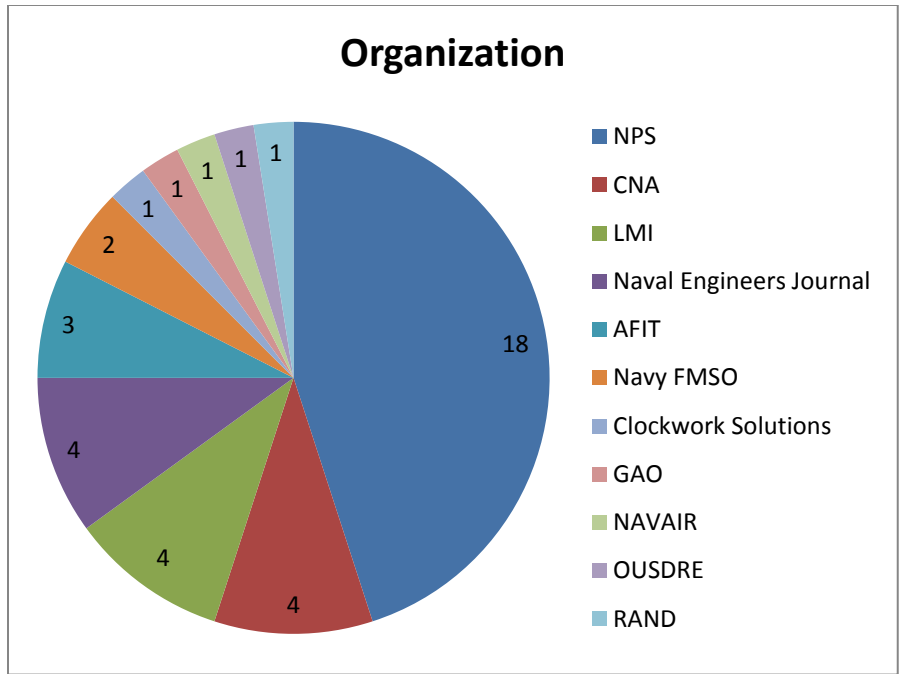


Figure 1

3.2. Date

These forty papers range in date from April 1982 to June 2011. The breakout of these in five-year increments is below.

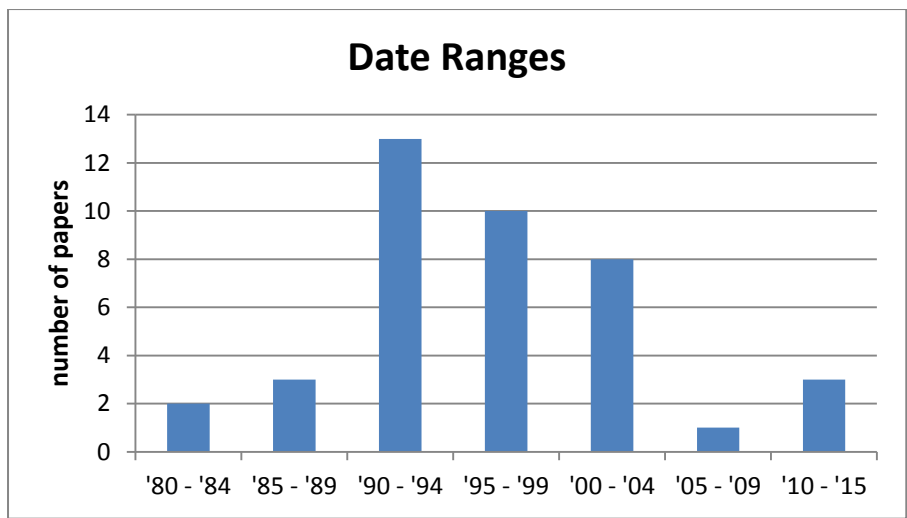


Figure 2

3.3. Branch of Military

These papers deal mostly with the United States Armed Forces, though two notable exceptions involve foreign militaries.

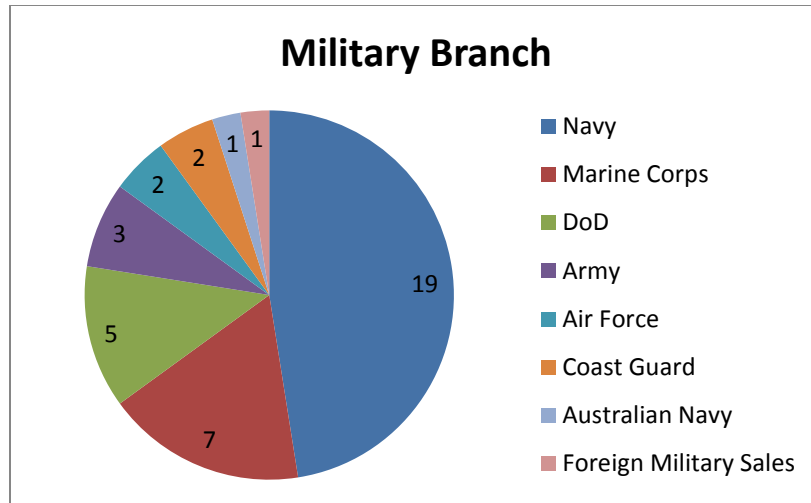


Figure 3

3.4. General Stance on RBS

A true/false value was recorded in the database for each of three possibilities describing a paper's general outlook toward RBS: whether this outlook was either positive or negative, or RBS methods were simply assumed in the discourse. As evidenced below, some papers did not fit any of these three possibilities, but still did discuss RBS.

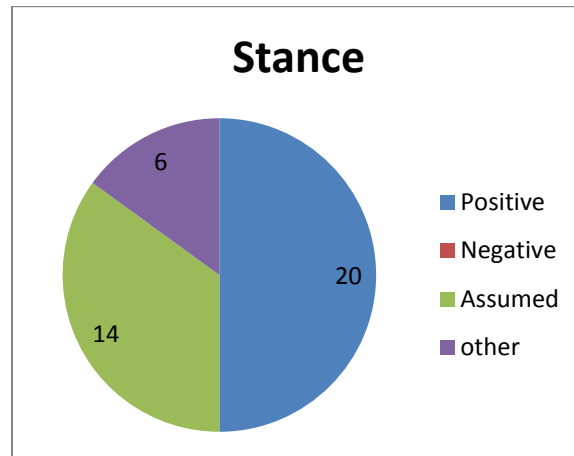


Figure 4

Another interesting analysis is what correlation exists between these papers' dates and their general stances on RBS. Below is a plot of these two categories together.

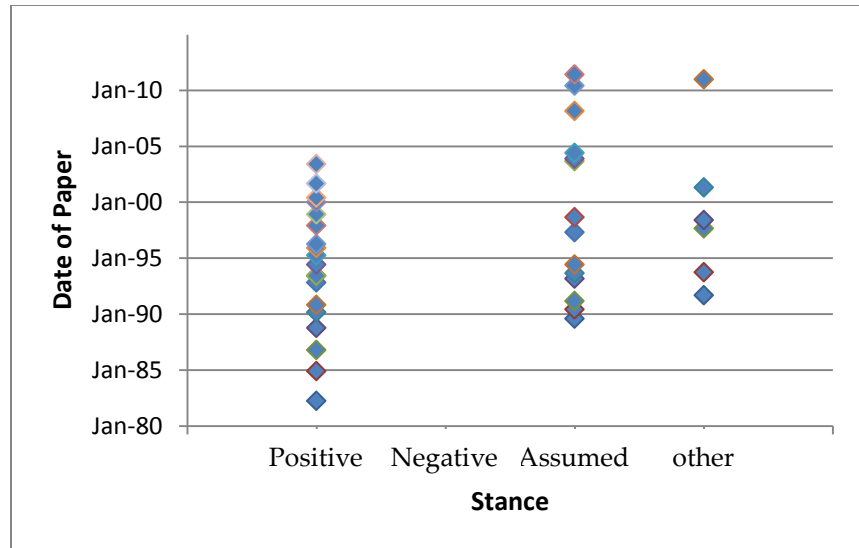


Figure 5

4. Detailed Discussion

4.1. Benefits of RBS

The papers that recommend the use of RBS indicate that its strength lies in that it links spares stockage levels directly to weapon system availability. Operational availability is a much better goal than individual part fill rates, since the point of stocking spares is to repair weapon systems to operational capacity, not to simply use spares. The optimization methods within RBS allow one to compute a spares package either maximizing availability for a specified cost or minimizing cost for a specified availability. This makes for a much more cost-effective method of sparing than previous approaches.

4.2. Complexities

The complexity most commonly cited by these papers—including some of the twenty papers specifically recommending RBS—was that, as opposed to the older, less complex methods of Demand Based Sparing, RBS requires significantly more data to compute optimal spares packages. If such comprehensive data gathering is not already in place, it can make the implementation of RBS a much more difficult process. This difficulty is most emphasized in papers dealing with the Marine Corps; their RBS implementation process was apparently hampered by data problems in terms of both scope and accuracy. This, however, did not deter any of these authors from the use of RBS in the Marines: of these seven papers, five had a positive stance, and the remaining two simply assumed RBS methods.

The prevailing opinion, then, is that any additional costs associated with whatever increase in data gathering is necessary for implementing RBS is offset by the savings inherent in its sparing process. Only one paper we found disputed this sentiment. In a 1993 Logistics Management Institute (LMI) study on the U.S. Coast Guard's modernization of the inventory-management

system at its nonaviation supply centers, Slyman and Zimmerman question, given these data requirements and the complexity of the algorithms utilized, “whether it is worthwhile to adopt an A_o [operational availability] approach when a response time approach¹ may mimic the A_o results” (p. 2-5). They do note afterward that the Coast Guard Aircraft Repair and Supply Center is moving toward an A_o-oriented requirements process (and that availability-based models tend to have greatest success in aviation support), but it is unclear why this distinction exists. Continuing on, they recommend that, if the nonaviation supply centers “were to consider changing from response time to an A_o as the measure of supply support, each should perform a cost and benefit analysis to justify the added costs of the readiness-based sparing approach” (p. 2-5). Considering that this seems to indicate that the authors themselves did not perform such an analysis, this throws some doubt on their questioning.

Of the six papers whose stance on RBS could not really be described as either positive or negative, four either saw it as effective but not yet practical in a certain context, due to the technological limitations of the time (as in Redding’s 1991 thesis), or pointed out weaknesses in current RBS models, sometimes suggesting ways to improve them (Kinskie, 1997; Lopez, 1998; GAO, 2001). None of these cases, therefore, questioned the underlying principles of RBS methodology. The only two to do that were the abovementioned LMI study by Slyman and Zimmerman and a 2011 study by Brauner, Lackey, and Halliday of the RAND Corporation.

This RAND study dealt with the initial spares provisioning packages (referred to as “push” packages) that accompanied the Army’s fielding of new technology. It “demonstrates the feasibility of using data on field demands for parts to improve push packages for new equipment as it is fielded to successive units” (p. iii), and compares the performance of such continuous, demand-based push package updates to packages developed by subject matter experts, by the Command Commodity Standard System using the Support List Allowance Card, and by the Visual SESAME (Selective Stockage for Availability, Multi-Echelon), an RBS model, tuned to 80% availability. Their method of using field data to update successive push packages performed the best in their two case studies, for both deployed and nondeployed units.

However, a few things are still uncertain about this study. Most importantly, it is unclear how the four methods in each case study compare. Looking at the data, they were obviously not configured to the same budget, but no other configuration goal is mentioned, whether availability or fill rate or otherwise. If they were not configured with any sort of similar goal, this casts some doubt on the accuracy of gauging their performance with equal weight. And they measured performance with the somewhat confusing and certainly incomplete metrics of accommodation rate², satisfaction rate³, and fill rate⁴, which say nothing to the severity of

¹ This “response time approach” is simply using mean system response time (or average customer wait time) as the ultimate measure of supply support. Any similarity its results share with those of an RBS method is due to its being a measure of time on backorder, a key component of any RBS algorithm.

² “The percentage of demands for parts on the ASL [authorized stockage list], whether or not the needed part is available” (p. xv).

whatever backorders did occur and therefore give no indication of a method's contribution to overall weapon system availability. While the notion of frequently updating one's spares packages using increased data gathering during the rollout of new technology is certainly a worthy suggestion, why not update the inputs to an RBS algorithm instead? That would seem to be a much more comprehensive approach.

5. Conclusions/Recommendations

The body of academic evidence supports that Readiness Based Sparing is the most efficient, comprehensive, and cost-effective method of sparing, due to its linkage of stockage levels to weapon system availability, allowing the user to optimize a spares package to maximize availability for a specified cost or minimize cost for a specified availability. The required use of RBS methods should be more plainly mandated in U.S. Air Force and Department of Defense policy.

³ "The percentage of accommodated requests for which there is stock available at the time of the request" (p. xv).

⁴ "The percentage of requests that are immediately filled from the supporting ASL" (p. xiv).

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⁵ In the interest of full disclosure, Mr. Burnworth was a part of HQ AFMC/A9A while writing this thesis.

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