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Surface Warfare Proficiency Knowledge Management Architecture

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NPS NRP Executive Summary
Title: Surface Warfare Proficiency Knowledge Management Architecture
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Naval Postgraduate School Graduate School of Operational and Information Sciences

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EXECUTIVE SUMMARY

Project Summary
As a key tenet of readiness, it is important to know, measure, and understand unit-level proficiency and individual career proficiency. This is especially relevant in trying to assess the seamanship of surface warfare officers (SWOs). This research works to develop a knowledge management (KM) approach in order to enable real-time tracking and future forecasting of SWO proficiency. The KM approach will be developed to enhance quality design characteristics such as intuitive operation, natural data entry, agility, and global reach.

Keywords: *surface warfare, readiness, proficiency, seamanship, knowledge management*

Background
The Navy SWO Community provides a vital, sophisticated capability to address increasingly dynamic and unpredictable threats around the world. Effective performance in the SWO Community requires a somewhat unique set of skills and capabilities, which center on life and work aboard ships at sea. Such skills and capabilities are generally expected to grow in predictable ways, and the Navy enforces established qualification procedures to help ensure that its people are proficient before taking responsibility for critical jobs aboard ship.

As with any human endeavor, however, different people possess varying levels of motivation, and each person learns new skills at an individual rate. Moreover, given the persistently high tempo of surface warfare operations around the world—coupled with shortened training times for SWOs—many critical skills are learned while underway via on the job training (OJT), mentoring under instruction (UI), and personnel qualification standards (PQS). Hence, it's difficult to know *exactly* how proficient each individual person aboard ship will be or, by extension, how ready a ship's crew is before getting underway. Furthermore, not all ships (even of the same class) are configured or operated identically, so OJT and experience aboard one ship may not be 100% transferrable to another. As noted in the Navy's recent comprehensive review (United States Fleet Forces Command [USFFC], 2017), factors such as these can contribute to questionable seamanship, ineffective communication, and even avoidable collisions at sea.

This leads to four primary research questions: What are the key factors that contribute to individual and unit readiness? How can such key factors be measured, tracked and forecasted? What kinds of readiness knowledge and information are required for intuitive yet reliable assessment? What kind of architecture can support a KM approach to measurement?

In this study, we bring to bear the state of the art in terms of Knowledge Flow Theory (KFT; Nissen, 2014), analysis, visualization, and measurement (Nissen, 2017; Nissen, 2019) in addition to recent research on the SWO Community (Nissen & Tick, 2018). We also understand the importance of working with our project sponsor to tap the detailed and relevant insight and experience available. Hence, this effort combines some of the best thinking about knowledge dynamics and measurement with that of surface warfare proficiency and readiness to create an integrated, practical, SWO-focused endeavor.

Findings and Conclusions
The research questions are pursued through the following major project tasks:
- Task 1: Research the academic, doctrinal and professional literatures to understand the key factors that contribute to individual and unit readiness.
- Task 2: Understand how such key factors can be measured, tracked and forecasted.

- Task 3: Build upon our understanding of knowledge and information flows to identify the readiness knowledge and information required for intuitive yet reliable assessment.

Key findings center on leveraging our knowledge visualization and measurement techniques to depict and quantify the dynamics of SWO knowledge aboard ship. For illustration, we excerpt a critical situation from the Navy's comprehensive review leading to the fatal collision aboard the *McCain*, which we analyze, diagram, and measure. We elucidate important, novel insights into the manner in which knowledge flows—and fails to flow—during maneuvers for which exacting seamanship and teamwork are required, and we both delineate and quantify the huge knowledge loss that can result from watch team changes at sea. We also offer recommendations for mitigating such knowledge loss. We report how it is critically important to expand Navy consideration of SWO proficiency beyond the individual level: *teams* of people (e.g., watchstanders on the bridge) must be able to work proficiently together. Hence, it is insufficient to track and assess the knowledge of individual SWOs aboard ship.

Key findings also center on leveraging knowledge, information, and processes associated with the Aviation and Submariner Communities. Dynamic knowledge analysis demonstrated through this research represents a novel capability for the SWO Community, elucidating keen and novel insights into the associated issues and processes that cannot be understood otherwise.

Recommendations for Further Research

We recommend future work with experienced SWO personnel to create the KM architecture noted above. We have many suggestions for approaching this future research, but there is much to be done now with the problems we've identified here but have yet to solve. On the bridge and elsewhere aboard ship, *team* knowledge and *team* performance are critical: It is insufficient for each individual officer and crew member to be knowledgeable, experienced and proficient. Rather, people must perform well on teams (e.g., watch standers on the bridge), and to do so, they must practice together. Team performance is important to track. This suggests that information about the watch bill—and watch performance— for instance, may prove useful, but much work is required to outline an effective and consistent approach.

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Acronyms

Knowledge Flow Theory	KFT
knowledge management	KM
on the job training	OJT
personnel qualification standards	PQS
surface warfare officer	SWO
under instruction	UI