

# Prototyping a Modernized Navy Personnel Qualification Standard (PQS) System

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SOARTECH

Modeling human reasoning.  
Enhancing human performance.

# Overview

- Navy's **Personnel Qualification Standards (PQS)** system is ripe for modernization
  - There is a need for standardized and centralized learning material
    - Rather than ad-hoc or distributed across locations
  - Sailors expect digital systems
    - Rather than paper-based and manually coordinated
  - Modern science of learning tools could monitor qualifications
    - Sailor readiness and skill progression
    - Effectiveness of all content over time
- What would a modernized digital PQS look like?

# Vendor Perspective

- Demonstrate “art of the possible” with an **agile, six-week development** effort to depict and win buy-in on what a digital PQS system would look like.

The screenshot displays the NETC (Naval Education and Training Center) Personnel Qualification Standard (PQS) Program interface. The header includes the NETC logo and navigation links for PQS Program Policy, PQS Model MGR, and Acronyms. The user profile for Dennis Mills (DCFN) is shown on the left sidebar, with a menu containing Completed Watchstations, My PQSs, My Records, My Bookmarks, Videos, and References. The main content area shows the user's PQS Qualifications, categorized into two sections: NAVEDTRA 43119-M(ch-1): Damage Control, Part I, Basic Damage Control (0% (0/6) Completed) and NAVEDTRA 43119-M(ch-1): Damage Control: Part II, Advanced Damage Control (0% (0/5) Completed). Each section lists specific qualifications with icons and titles.

Qualification ID	Qualification Title	Completion Status
301	Basic DC Communications	0% (0/6) Completed
302	Basic First Aid	0% (0/6) Completed
303	Basic Firefighting	0% (0/6) Completed
304	Fire Watch Stander	0% (0/6) Completed
305	Basic CBR Defense	0% (0/6) Completed
306	Basic DC	0% (0/6) Completed
307	Adv Damage Control	0% (0/5) Completed
308	Team Leader	0% (0/5) Completed
309	Adv CBR Defense	0% (0/5) Completed
310	Adv First-Aid/Stretcher Bearer	0% (0/5) Completed
311	AFFF/Transfer Station Operator	0% (0/5) Completed

# Ready Relevant Learning (RRL)

- Today, RRL is fundamentally changing how Sailors learn
  - All aspects of RRL are focused on making a Sailor an optimal performer
- **Learning Continuum:** how could PQS provide the right training at the right time?
  - Shorten the time throughout a career between training and on-the-job need
- **Modern Delivery at Point of Need:** How can PQS leverage digital technology?
  - Incorporate modern capabilities like linked systems, authoritative data
- **Integrated Content Development:** How do we ensure training is valid & relevant?
  - Manage change and mitigate obsolescence in an evolving environment

# Prototype Design Goals

- Ensure safety and mission completion never falter
  - Must earn trust in the digital system
- Minimize human-system disruption
  - Will continue 50 years of tradition and culture
- Minimize disruption in Fleet workflows
  - Keep clear correspondence with existing paper process
- Preserve existing Qualifier-Sailor interactions
  - Maintain or increase accountability within the system



# Rapid Development

- Six week total development cycle
  - Agile engineering approaches in a DoD setting
- First week
  - Kickoff and domain selection: Damage Control
  - Three full days of face to face design meetings between stakeholders and vendor engineers
- Weekly engineering sprints
  - Weekly status updates to all stakeholders
  - Weekly remote demos of current functionality
- Fast feedback from subject-matter experts
  - Quick and collaborative software changes
  - Continuous learning and improving the product



# Developed Features

- Learning Continuum Display
- Learning Continuum Portal
- Learning Resources
- Qualifier Interface
- xAPI Integration
- Backend / Learning Data Stack
- Web Architecture



# Learning Continuum Display

- Present learning material on a continuum
  - Sailors see the connection to their Naval careers
- Track and guide Sailors at all stages of career life cycle:
  - Time
    - Accession, First Sea Tour, Shore Tour, Second Sea Tour, and Beyond
  - Competencies
    - Technical, Professional, and Leadership development

T  
P  
L

ACCESSION

EPACT  
BECC Advanced  
DC Strand

1st Sea Tour

General SCBA  
PQS  
Damage CNTPO

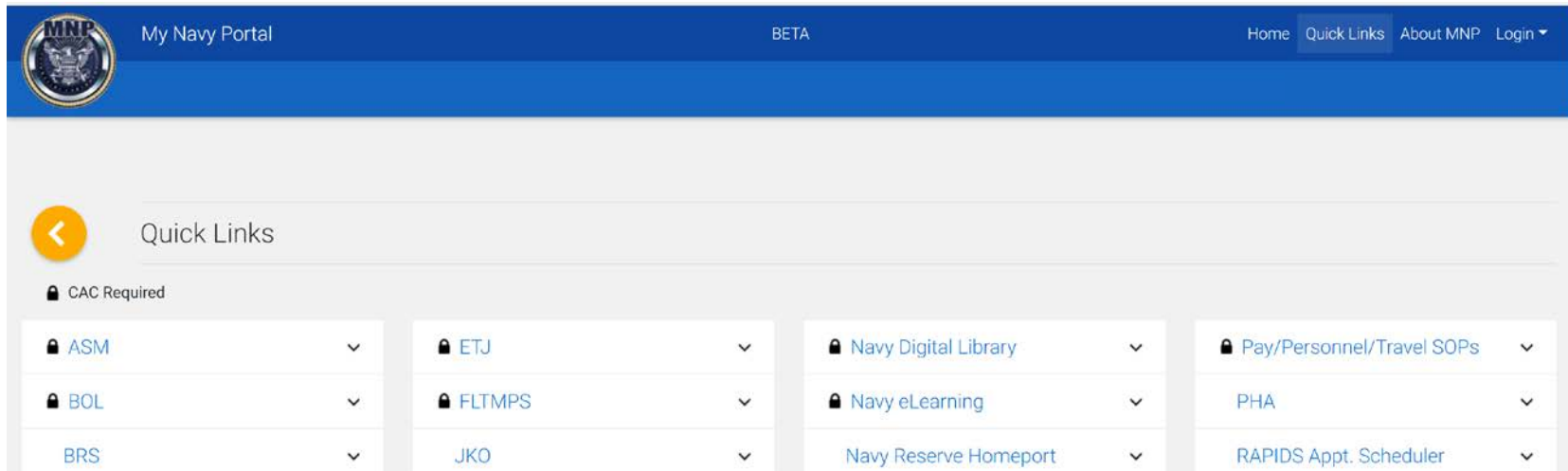
Shore Tour

2nd Sea Tour

Beyond



# Learning Continuum Portal



- Single access entry into learning topics and resources
- Research character can support long-term relationship
- In the future, will facilitate directing sailors through myriad of training resources and suggest personalized “next steps” for learning



# Learning Resources

- Repository of validated learning material supplied at the point of need
- Supports multiple media formats including future augmented reality
- Links to resources embedded directly in the question itself

The screenshot displays a learning management system interface. At the top right, there are links for "POS Program Policy" and "POS Model M". The breadcrumb trail reads: "Learner > PQS Quals > 301 - Basic DC Communications > 101 - DC Safety Precautions Fundamentals". The main content area shows a question titled "101.01 Discuss the concept of ORM." with a "Go To" dropdown menu. Below the question, there is a "References" section with a PDF icon. A "SUBMIT FOR SIGNOFF" button is visible in the top right of the question area. At the bottom of the question area, there are navigation buttons: "< PREVIOUS", "Topic 1/31", and "NEXT >".




# Qualifier Interface



- Follows Sailor progress as evidence of readiness for assessment
- Dashboard of progress and open signoff requests
- Qualify students on particular PQS topics
- PQS section-level signoffs

Approvals for Dennis Mills Go To

Time Requested: 7/31/2018, 2:59:03 PM

101.01 Discuss the concept of ORM.

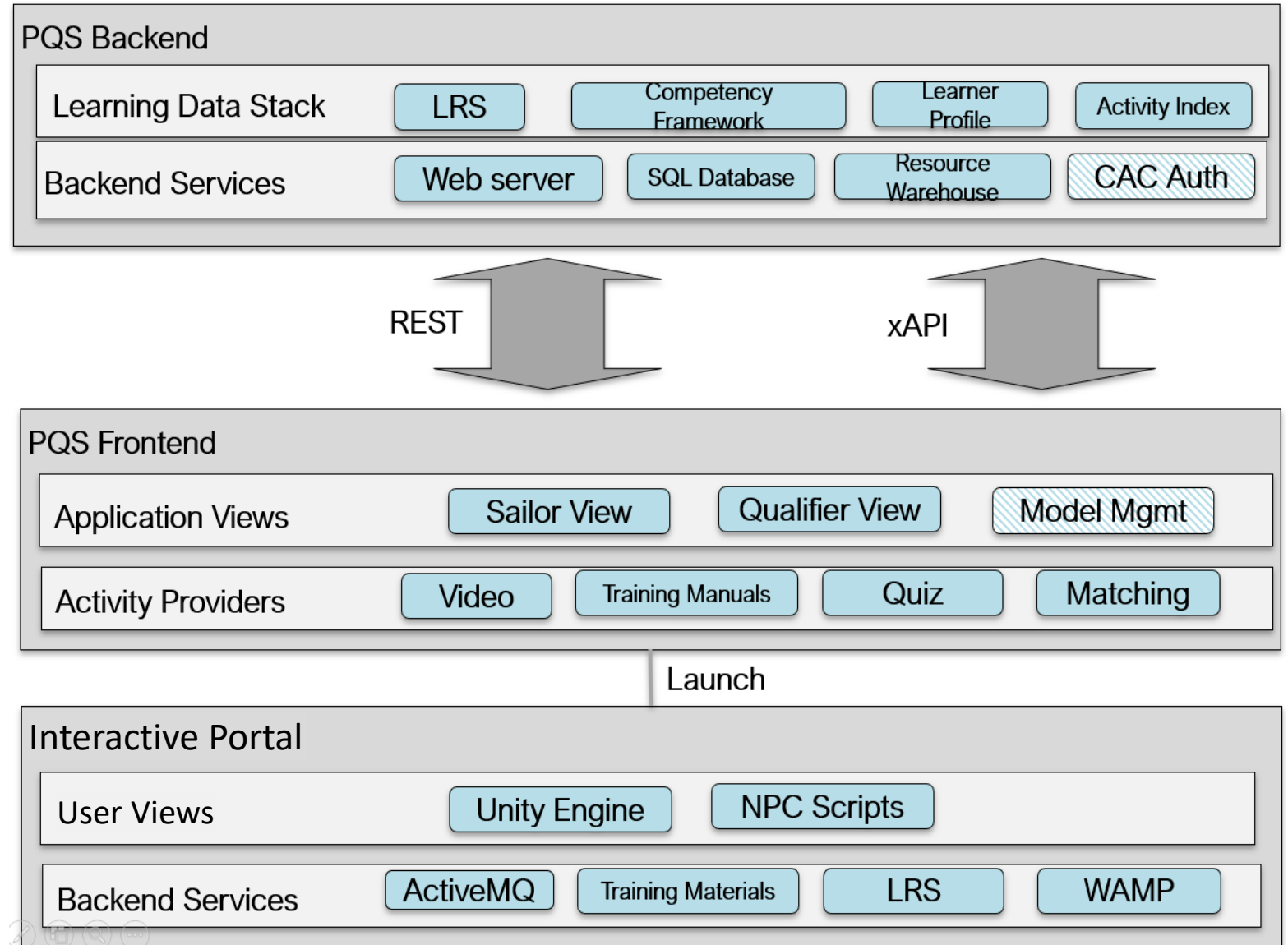
Recent	Open Signoffs	Last Name	First Name	Dept.	Div.	Rate	Topic	Review
	3	Mills	Dennis	ENG	R	DCFN	101.03	

# xAPI

- Track fine-grained student-content interactions
  - Pages viewed in a PDF
  - Percentage of video watched
  - Content completed, how recently and how quickly
  - Individual answers correct / incorrect in practice quizzes
- Can gather longitudinal statistics and enable inferences
  - Content view count indicating utility to Sailors
  - Usage in context indicating use case (reference, test prep, introductory)
  - Change over time indicating possible obsolescence of content

# Implemented Architecture

- Moves Science of Learning concepts into operational use
- Leverages existing DoD and Naval research investments



# Backend / Learning Data Stack

- Learning Record Store (LRS)
  - Serves as an xAPI data warehouse
  - Stores evidence about learners, resources, and qualifications
- Competency framework
  - Defines and relates job tasks, competencies, and underlying knowledge or skills
- Learner profile
  - In our use, a long-term record of inferences about student performance and qualifications
- Activity index
  - Maps every Naval watch station to required learning material and PQS qualifications

# Web Architecture

- RESTful web services back end written in Java (JAX-RS)
  - Can support multiple user interfaces if needed
- User interface / front end written in Vue.js
  - Can run on laptop or mobile devices
- Data storage with Postgres DB for logins, user roles, learning ontologies
  - LRS for activity records, qualifications
- Can embed and deliver a variety of content with xAPI integration:
  - Movies (HTML5 video player)
  - PDF (JS-based PDF renderer)
  - Multiple-choice quizzes
  - Links to launch external learning activities

# Technical Challenges

- Deployed hardware must be compliant with DoD IA guidelines
  - NIST SP-800
  - DISA's STIG (Security Technical Implementation Guides)
- Interoperability between data silos – even within the Navy, there are challenges to collecting and centralizing information
  - Challenges collecting training material
  - Legacy training exists in Adobe Flash, must be rewritten for modern Information Assurance
- DoD needs shared standards for xAPI usage
  - Common challenges: Unique identifiers not aligning, verb mismatches, inconsistent triggers, different ways of referencing content (ID, URL, etc), link data versus catalogs for vocabulary



# Lessons Learned

- Tight communication loop between vendor and DoD representatives
  - DoD stakeholders, funders, leadership
  - Subject-matter experts and end users
- Software solutions should be agnostic to hardware choices
  - Responsive UI design to flexibly meet deployment constraints
  - Visual clarity for use on multiple devices
- Open challenges in integrating LRS solutions in real-time web systems
  - Existing SOTA LRS solutions have slow ( $> 100$  ms) response times for retrieval
  - Cannot process inside the user interaction timeframe
  - Local caching layer, offline processing, and process batching needed

# Conclusions

- Agile development in a DoD setting
- Working prototype with IA compliance enables demonstration and feedback
- xAPI enabled
- Supports Ready Relevant Learning to help every Sailor perform at peak



# Questions?

- **Acknowledgement**

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Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NETC or the Department of Defense.

- **For more information**

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