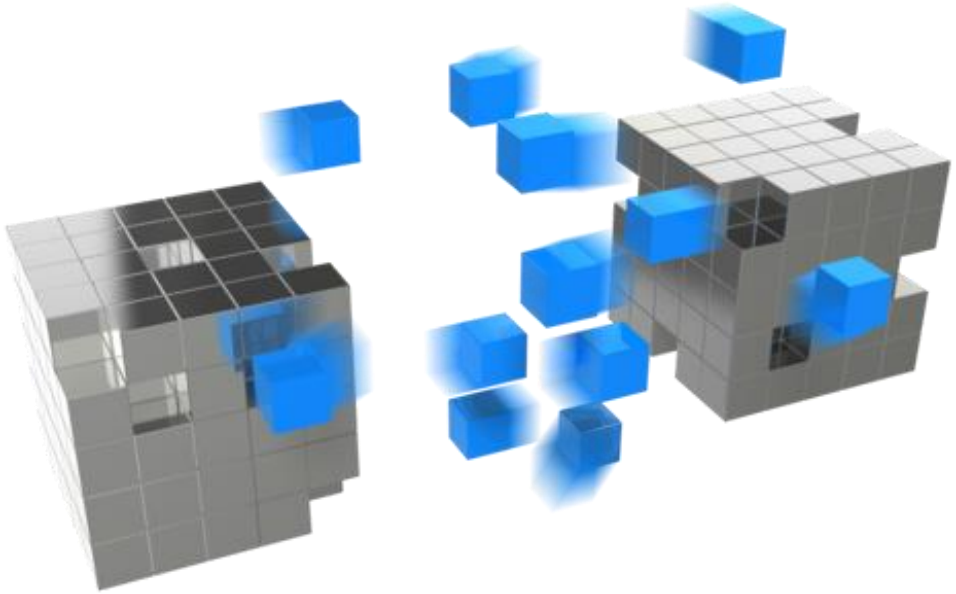
NSRP Project: Knowledge Provisioning to Improve and Simplify ABS Digital Compliance

TIA No. 2019 - 474

Business Technologies / Digital Shipbuilding Committee
Virtual Panel Meeting
May 21, 2020

Agenda

Project Overview
Knowledge Aware and Knowledge Provisioning
NSRP Project Background
Project Results
ABS / Auros Operating Model
Next Steps



Project Overview

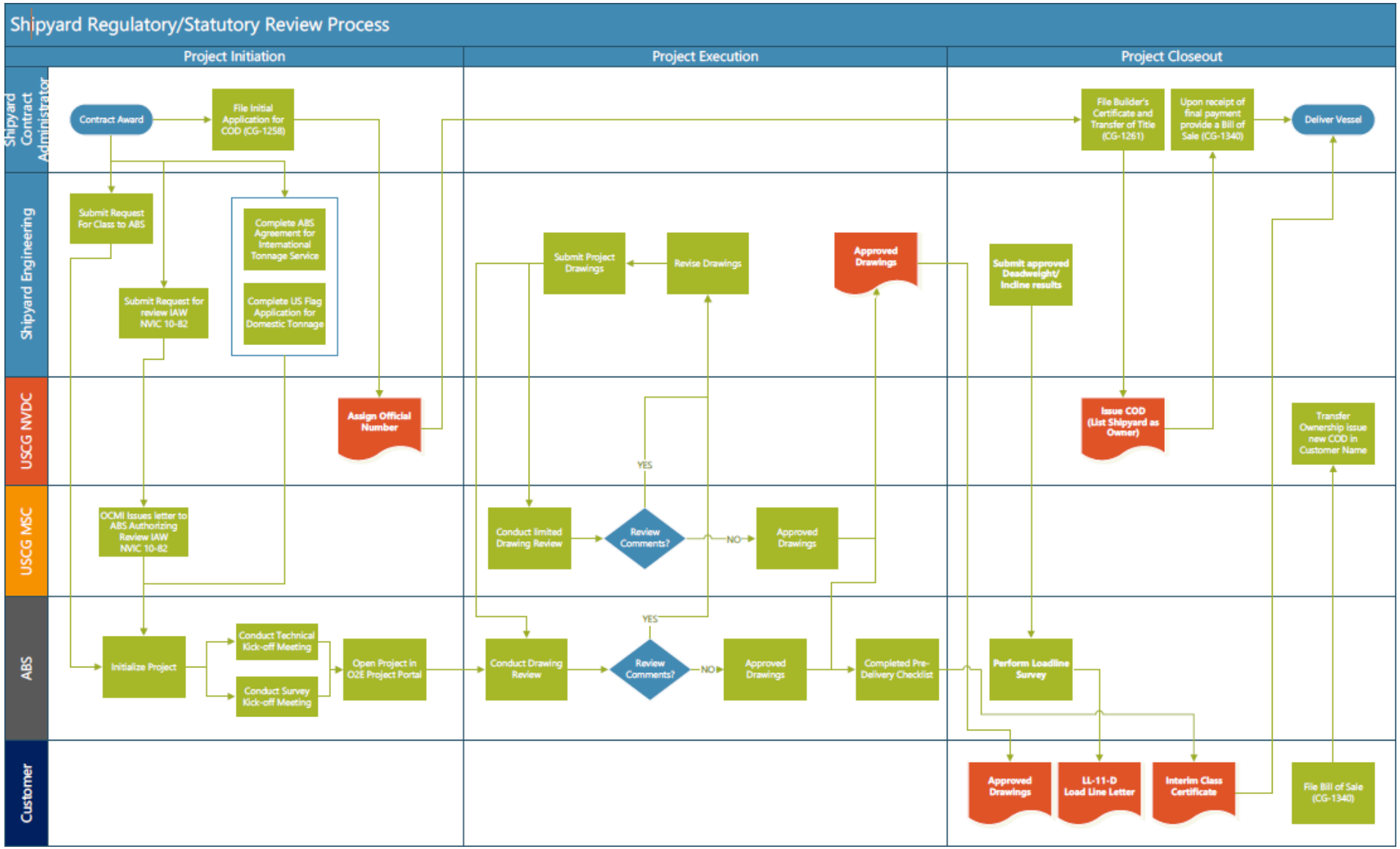
Project Team Members

- Conrad Shipyard, LLC
- ABS – American Bureau of Shipping
- Auros Knowledge Systems, LLC
- Hepinstall Consulting Group
- Victoria Dlugokecki, P.E.
- John Walks – Ingalls (PTR)
- Nick Laney – ATI (Technical Manager)

Overall Project Objective

Improve and simplify the ABS compliance process through digital provisioning and compliance capture using Knowledge Aware techniques

Problem Statement



Advantages

- Simplify ABS Regulatory Compliance
- Rules are Active vs Passive
- Single Source of Truth
- Rules are always current
- Eliminate building checklists and calc sheets
- Ultimately link into CAD for Compliance Validation

Project Deliverables and Goals

Enable Technology

Enable robust digitalization of ABS rules

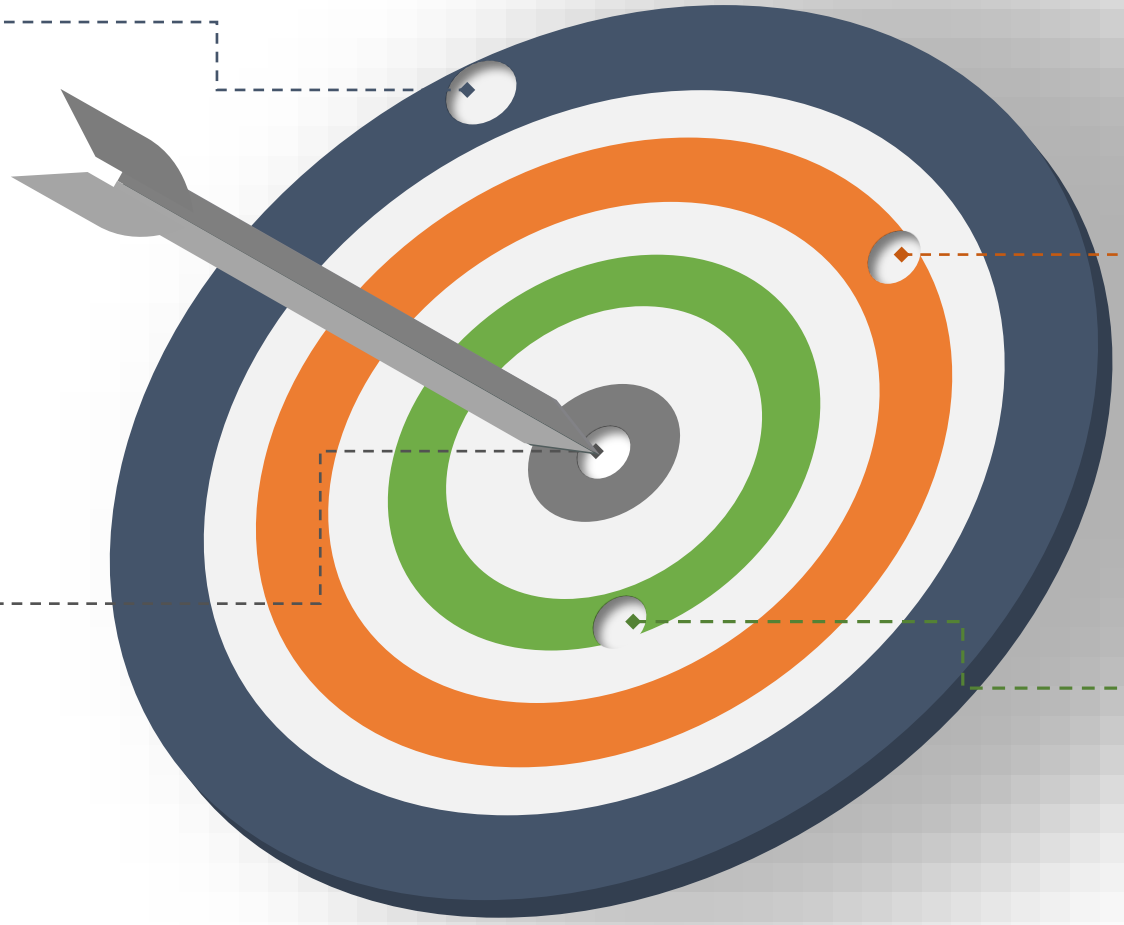
Digitalization of selected ABS rule sets

- 2019 ABS Tank Barge and Deck Barge Rules

Operating Model

Define potential future operating model

Investigate applicability for other external requirement sources (i.e., Mil-Stds)



Streamline

Streamline preliminary ABS compliance review process

Shorten Cycle

Shorten communication cycle between ABS / Shipyards

Knowledge Aware and Knowledge Provisioning

Knowledge Aware (KA)

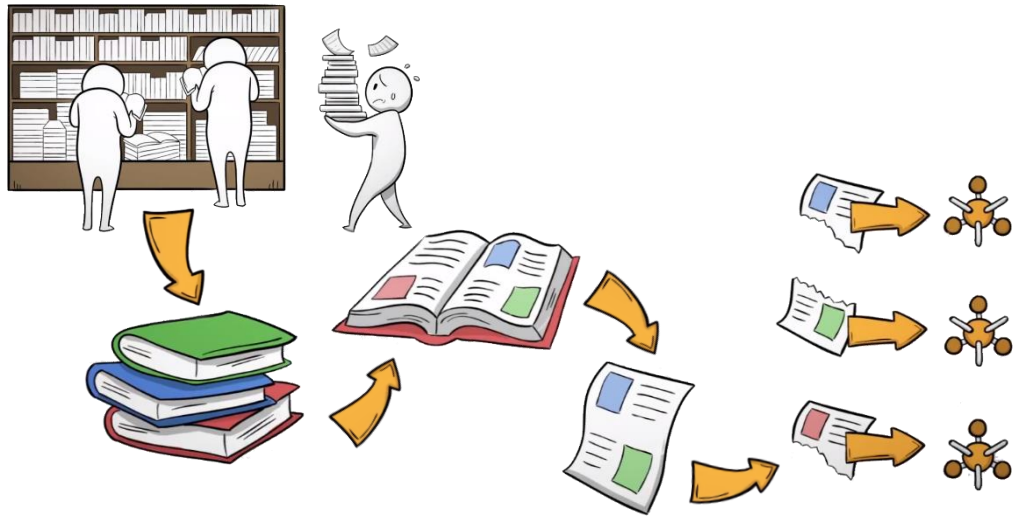
'Knowledge Aware' represents a fundamental shift in how knowledge is managed and provisioned.

Static
Immediately out of date
Impossible to use while driving

Dynamic
Easy to use
Provisions directions as needed
Provide insights from other drivers

Knowledge Packets

Existing Documentation & Know-How



Knowledge Packets (K-PACs)

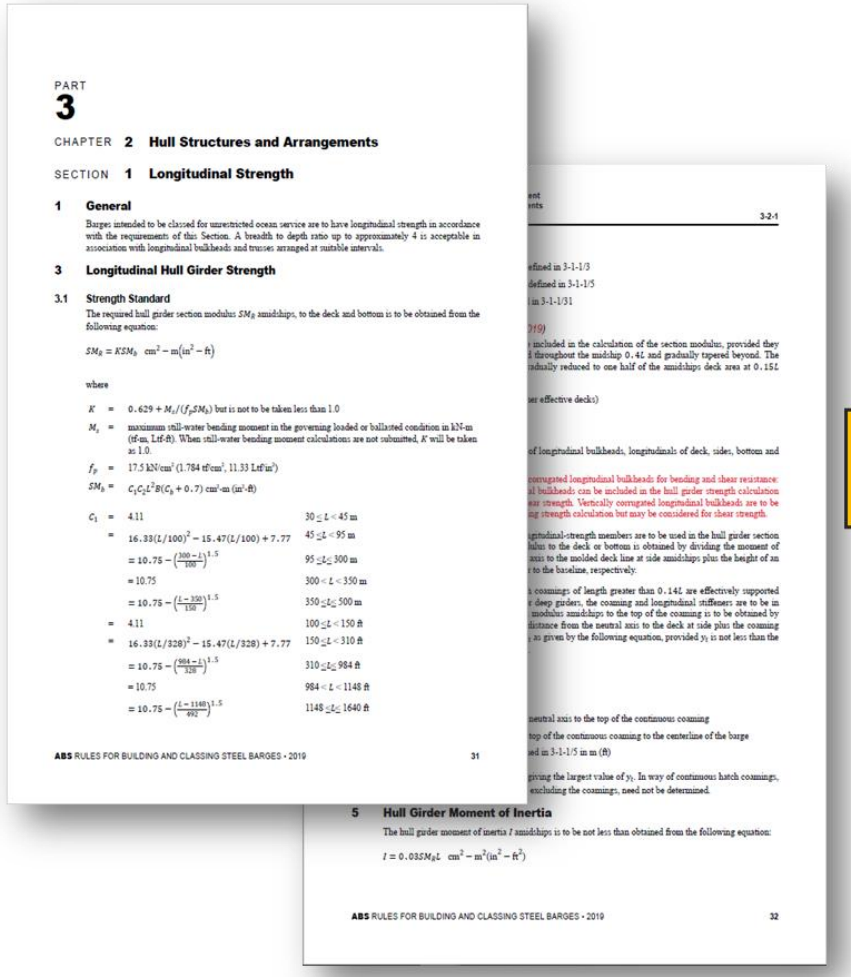
Assessment Controls

Knowledge Packet & Assessment Control Technologies

Knowledge Packets

Assessment Control

Knowledge Aware for Regulatory Compliance



PART
3

CHAPTER **2** **Hull Structures and Arrangements**

SECTION **1** **Longitudinal Strength**

1 General

Barges intended to be classed for unrestricted ocean service are to have longitudinal strength in accordance with the requirements of this Section. A breadth to depth ratio up to approximately 4 is acceptable in association with longitudinal bulkheads and trusses arranged at suitable intervals.

3 Longitudinal Hull Girder Strength

3.1 Strength Standard

The required hull girder section modulus SM_R amidships, to the deck and bottom is to be obtained from the following equation:

$SM_R = KSM_b$ $cm^2 - m(in^2 - ft)$

where

K = $0.629 + M_s/(f_p SM_b)$ but is not to be taken less than 1.0

M_s = maximum still-water bending moment in the governing loaded or ballasted condition in kN-m (tf-m, Ltf-ft). When still-water bending moment calculations are not submitted, K will be taken as 1.0.

f_p = 17.5 kN/cm^2 (1.784 tf/cm^2, 11.33 Ltf/in^2)

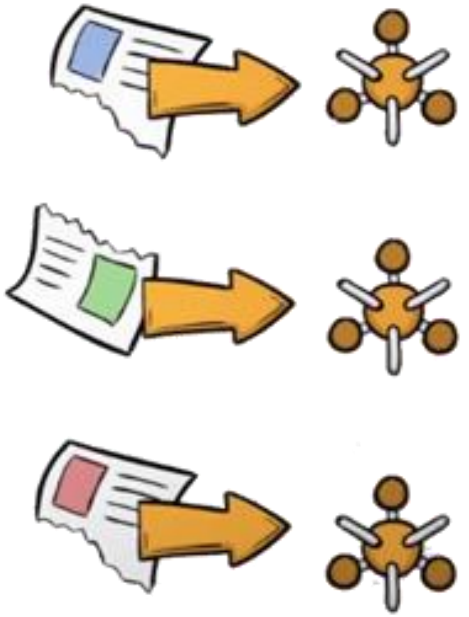
SM_b = $C_1 C_2 L^2 B(C_b + 0.7)$ cm^2-m (in^2-ft)

C_1 =	4.11	$30 \le L < 45$ m
=	$16.33(L/100)^2 - 15.47(L/100) + 7.77$	$45 \le L < 95$ m
	$= 10.75 - \left(\frac{300 - L}{100}\right)^{1.5}$	$95 \le L \le 300$ m
	$= 10.75$	$300 < L < 350$ m
	$= 10.75 - \left(\frac{L - 350}{150}\right)^{1.5}$	$350 \le L \le 500$ m
=	4.11	$100 \le L < 150$ ft
=	$16.33(L/328)^2 - 15.47(L/328) + 7.77$	$150 \le L < 310$ ft
	$= 10.75 - \left(\frac{984 - L}{328}\right)^{1.5}$	$310 \le L \le 984$ ft
	$= 10.75$	$984 < L < 1148$ ft
	$= 10.75 - \left(\frac{L - 1148}{492}\right)^{1.5}$	$1148 \le L \le 1640$ ft

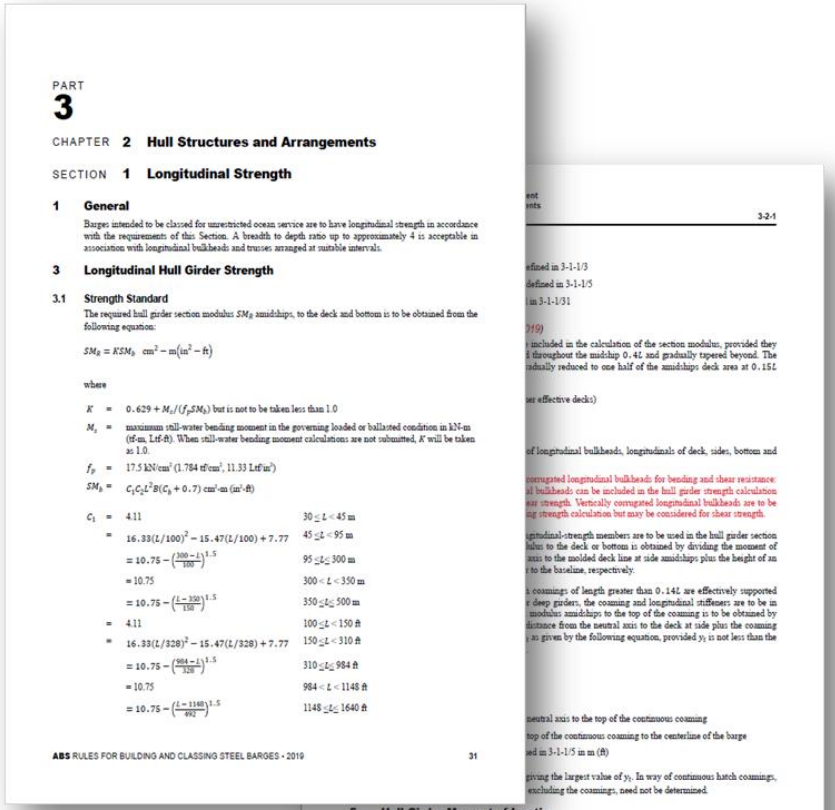
5 Hull Girder Moment of Inertia

The hull girder moment of inertia I amidships is to be not less than obtained from the following equation:

$I = 0.03 SM_R L$ $cm^2 - m^2(in^2 - ft^2)$



Knowledge Aware for Regulatory Compliance



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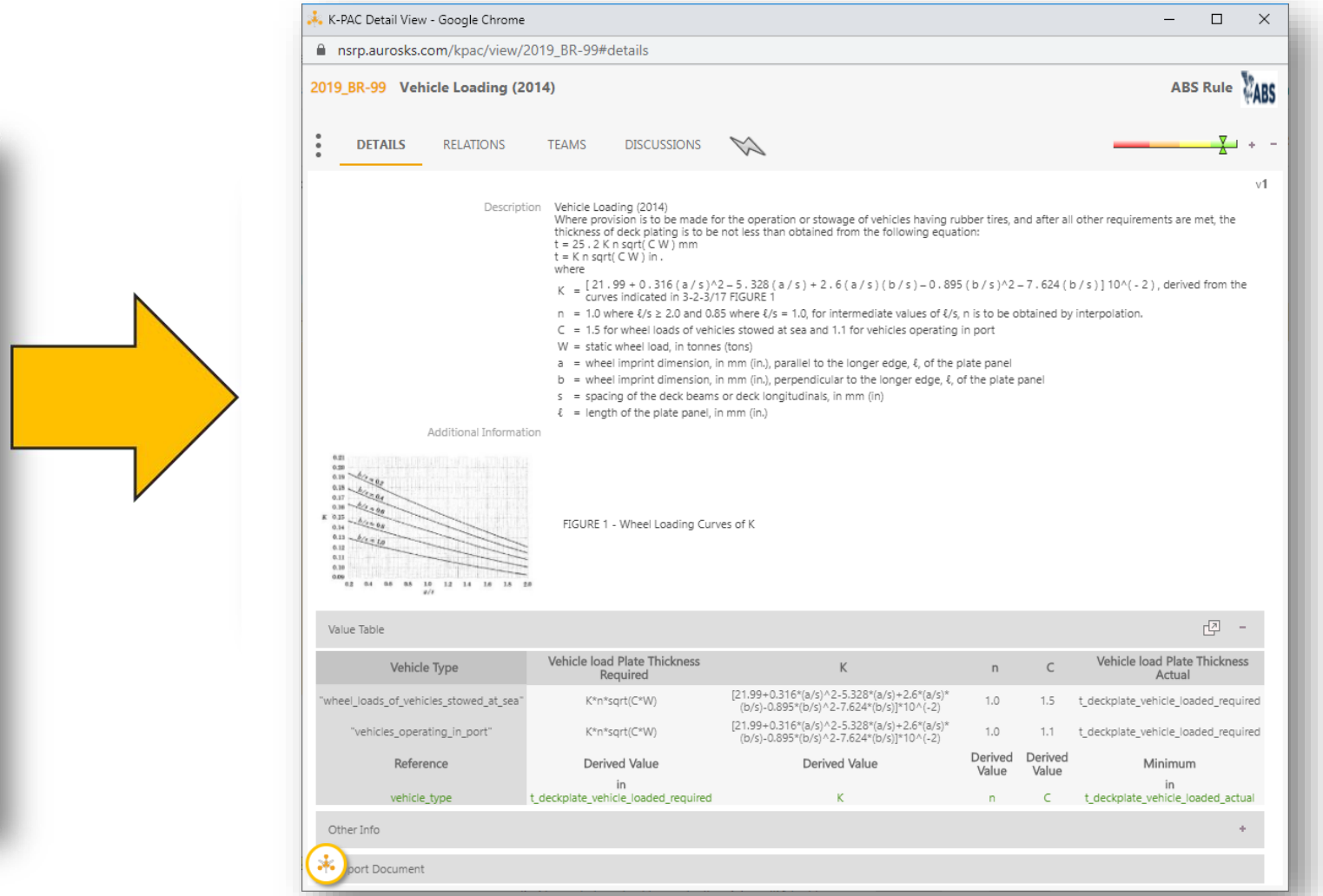
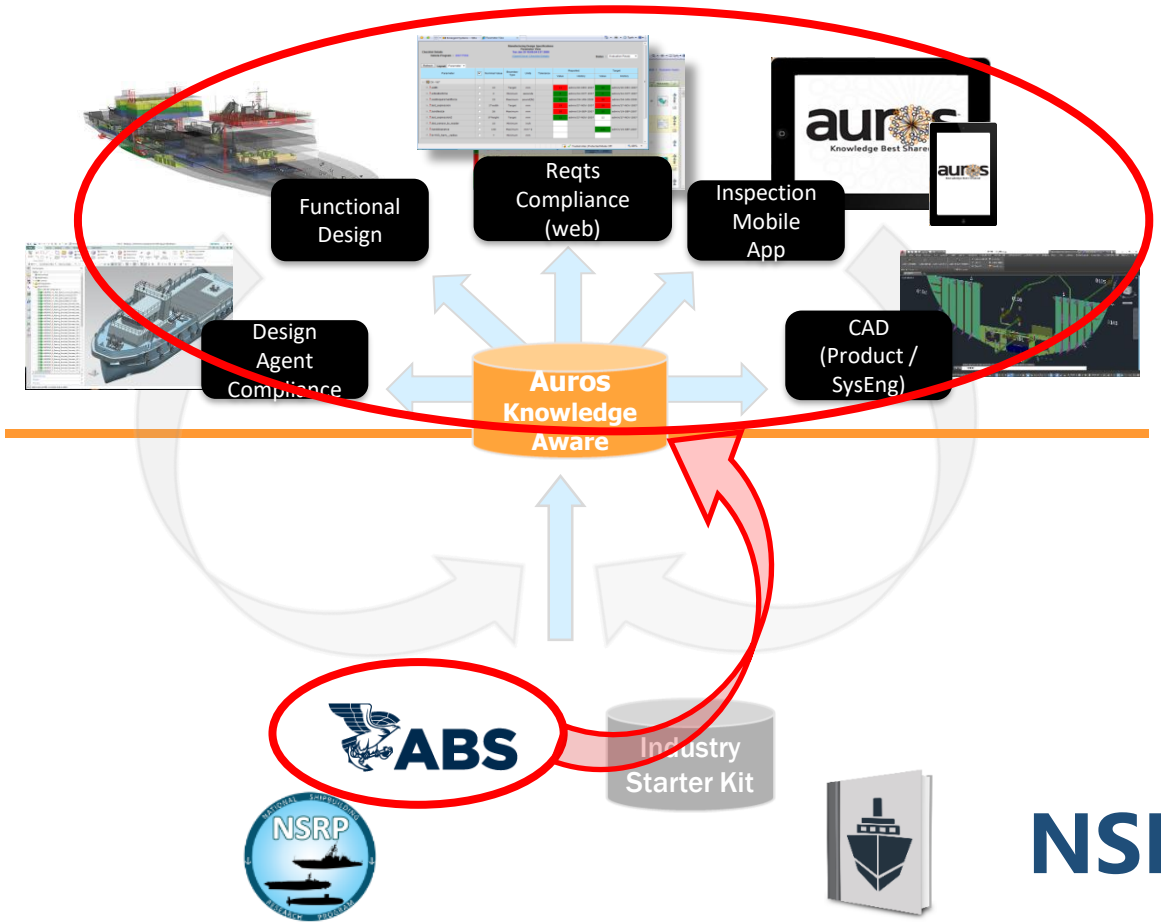
$I = 0.035 M_R L$ cm^2 – m^2(in^2 – ft^2)

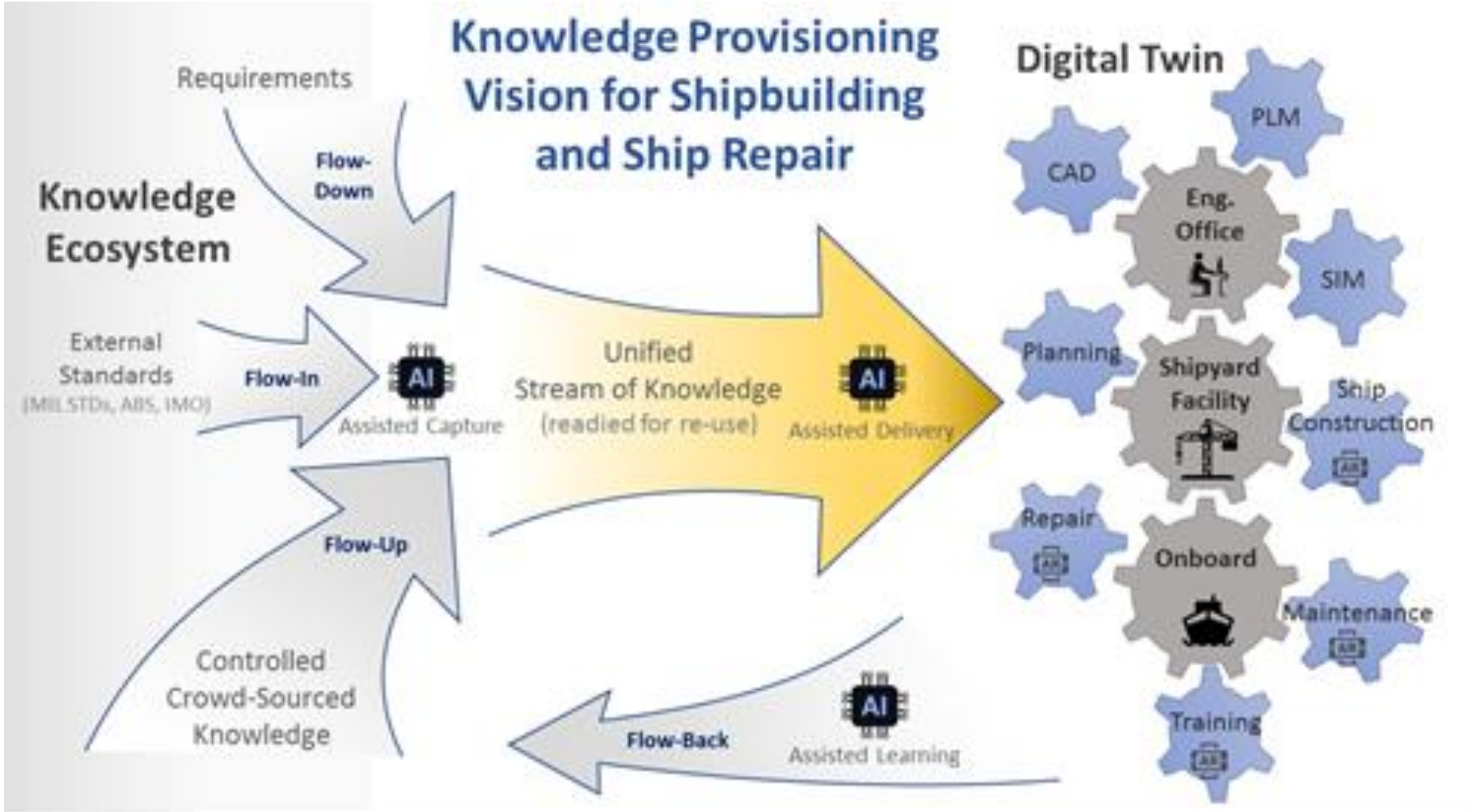




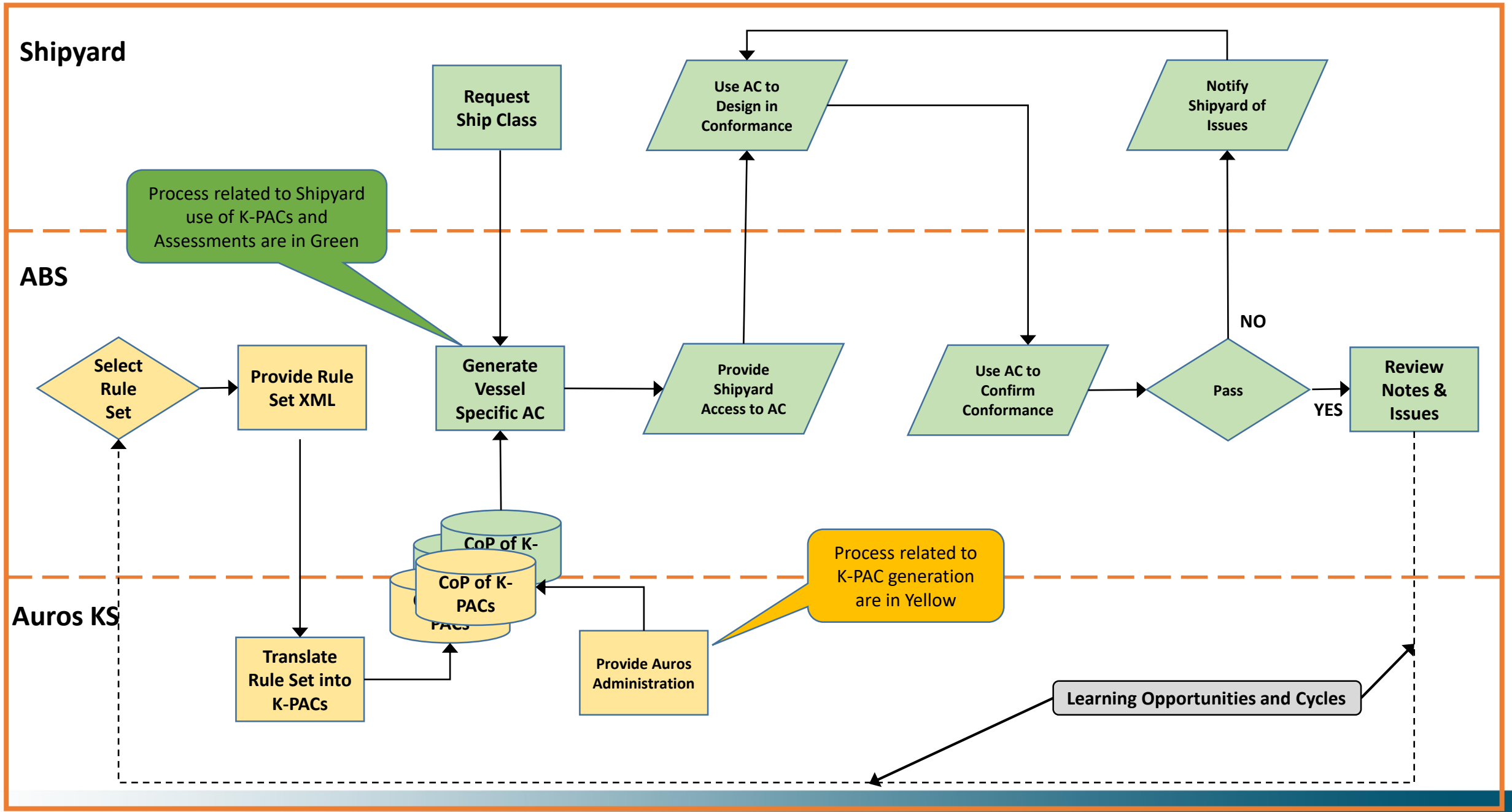
NSRP Project Background

Knowledge Provisioning for Shipbuilding- NSRP

KP Vision for Shipbuilding and Ship Repair



Project Results

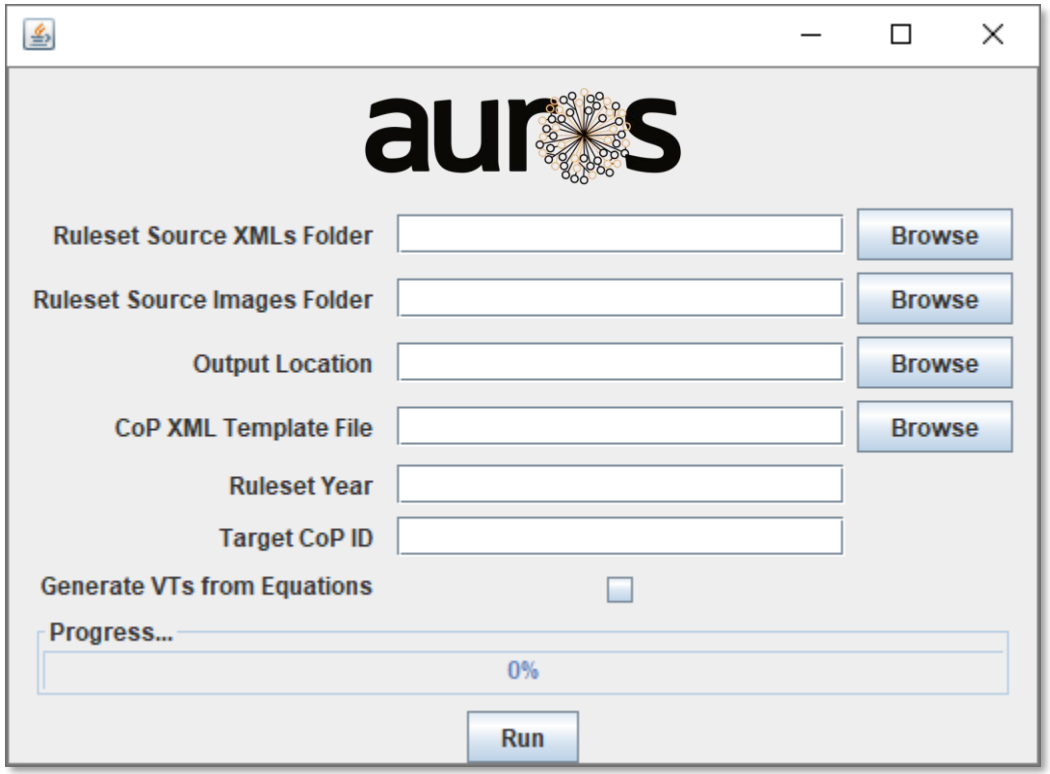

Shipyard
ABS
Auros KS
Request Ship Class
Use AC to Design in Conformance
Notify Shipyard of Issues
Process related to Shipyard use of K-PACs and Assessments are in Green
Select Rule Set
Provide Rule Set XML
Generate Vessel Specific AC
Provide Shipyard Access to AC
Use AC to Confirm Conformance
Pass
NO
YES
Review Notes & Issues
CoP of K-PACs
Translate Rule Set into K-PACs
Provide Auros Administration
Process related to K-PAC generation are in Yellow
Learning Opportunities and Cycles

Levels of Knowledge Packet Integration

- Tier 1
  - Rules converted into Knowledge Packets containing text and images
  - Non-executable
- Tier 2
  - Tier 1+
  - Executable equations (outside of CAD applications)
- Tier 3
  - Tier 2+
  - Executable equations with data exchange with CAD applications

XML Translator

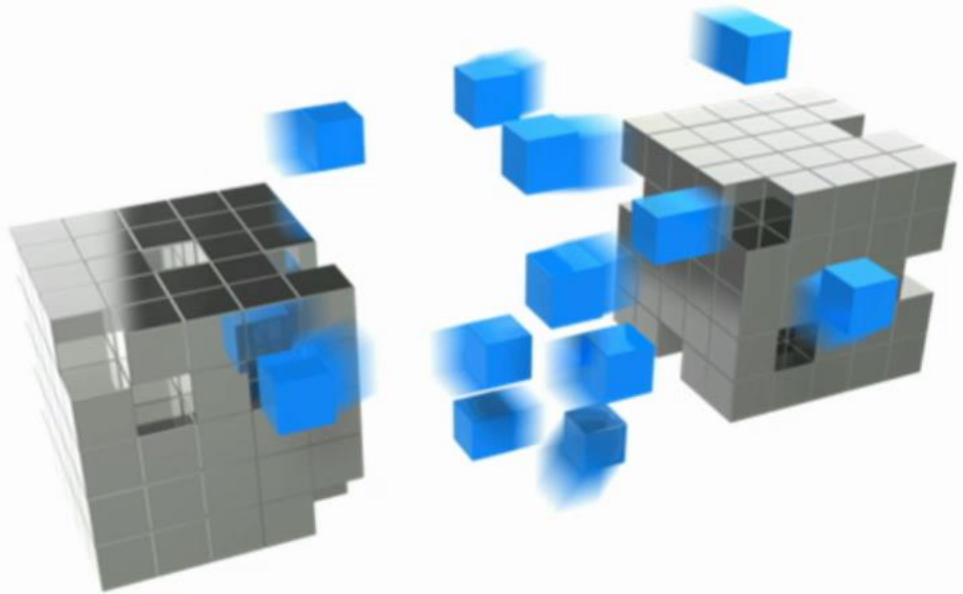
- Stand-alone Java based XML Translator application
- Converts ABS DITA XML source files meant for publication into Knowledge Packets
- Converts passive equations into dynamic executable rules



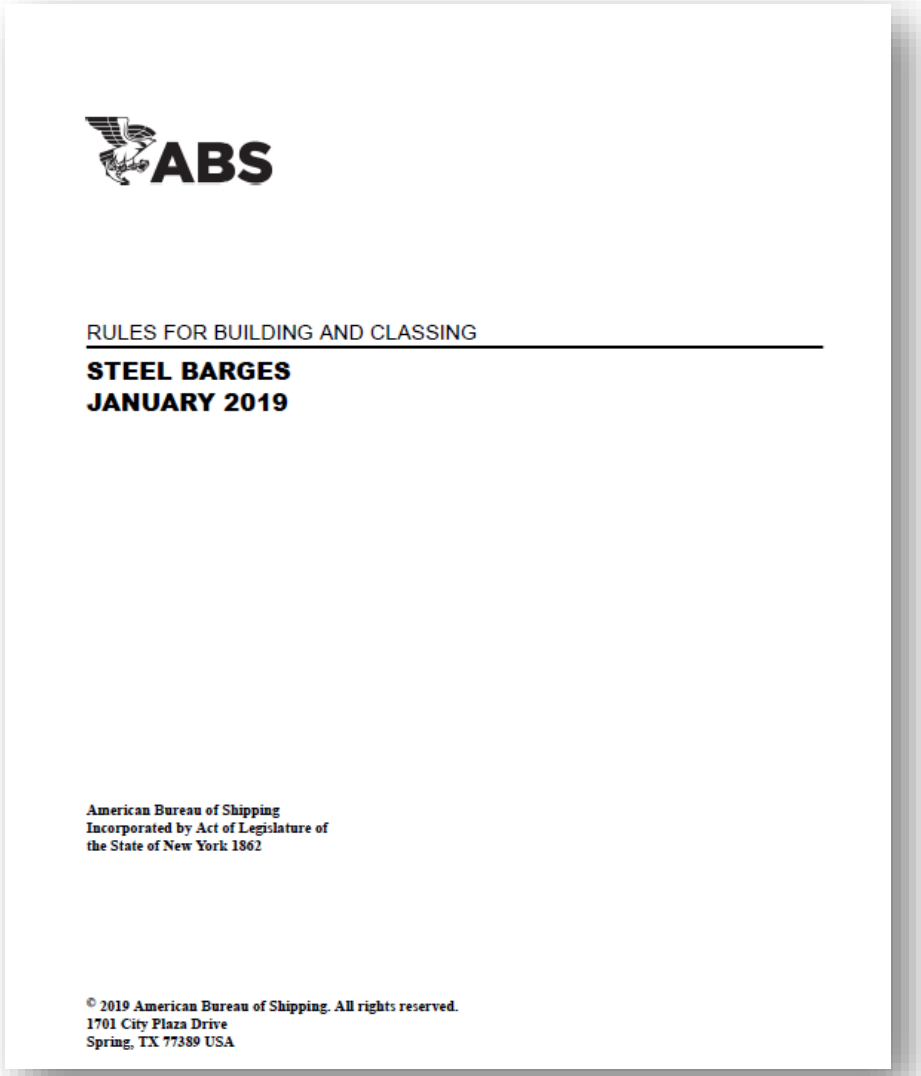
ABS to K-PAC Translator Status

- Production Version of Translator Released December 2019
- Translated “ABS Steel Barges – 2019”
  - Chapters 3 & 5 (238 pages)
- Statistics
  - 31 ABS XML source files converted
  - Total of 507 Knowledge Packets
  - 75 Knowledge Packets included executable rules
  - Translator conversion time = 11 seconds

XML Translator Demonstration



Project Pilot



ABS

RULES FOR BUILDING AND CLASSING

STEEL BARGES
JANUARY 2019

American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862

1701 City Plaza Drive
Spring, TX 77389 USA

Pilot

Conducted at Conrad Shipyard, St. Rose Office, December 2019

- Pilot Participants
  - Conrad
    - Shaun Hunter
    - Britt Zeringue
    - Brent Blackburn
  - Auros Knowledge Systems
    - Steve Boisvert
    - Sean McEvilly
- Scope of Pilot
  - Single Hull
  - Functional Design (Shell Plating / Deck calculations)
- Knowledge Provisioning
  - 27 Assessments Generated
  - ~1 Minute to Create 27 Assessments
  - 21 K-PAC Evaluations Completed
- Pilot Learnings
  - Enhancement Required to Create Input Parameter Instances

Metrics

- Current Process
  - Time to create Hull Scantling XLS-based calc tool – 1 month
  - Time to calculate Hull Scantlings– 40 hours
- Knowledge Provisioning Process
  - Time to create Auros assessments / quantity of assessments
    - ~1 Minute to Create and Provision 27 Assessments
  - Time to calculate Hull Scantlings
    - Unable to measure during pilot (Software enhancement required to create input parameters instances – Auros IQ4 release 09/2020)
    - Anticipated time reduction of 70% - 90% to calculate Hull Scantlings

Project Deliverables / Outcomes

- XML translator to automate digitization of ABS rules
- 4 Auros Software Enhancements Identified and Incorporated for ABS Rule Provisioning & Assessment
- ABS Authoring Best Practices Guide to Enable Digitization
- Memorandum of Understanding between ABS and Auros, LLC, scheduled to be signed Spring 2020, to:
  - Digitize and Provision ABS Rule Sets
  - Develop Roadmap to enable Provisioning of Tier 2 & Tier 3 K-PACs

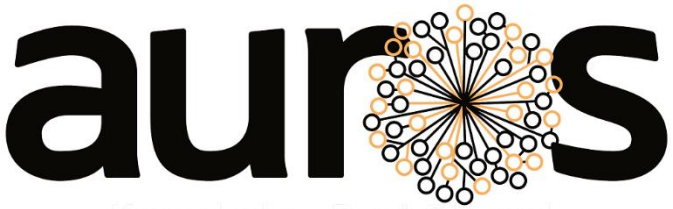
Application for Mil Stds Provisioning

- Translator approach used for ABS rules (XML files) is not applicable to Mil-Stds
- Mil Stds Source Media includes:
  - Word Files
  - PDF
  - Hard Copy
  - Others
- Utilize recent advances in AI to parse and structure unstructured content – Approved RA Project (TOA 2020-302)

Evidence of Value

- ABS / Auros Memorandum of Understanding
- Digitalization of ABS Rules includes executable Elements replacing the need to create calculation sheets
- Project Specific Tailored Ruleset can be provisioned rather than an entire Ruleset
- Provides pathway to Automated Compliance Check in CAD

Next Steps

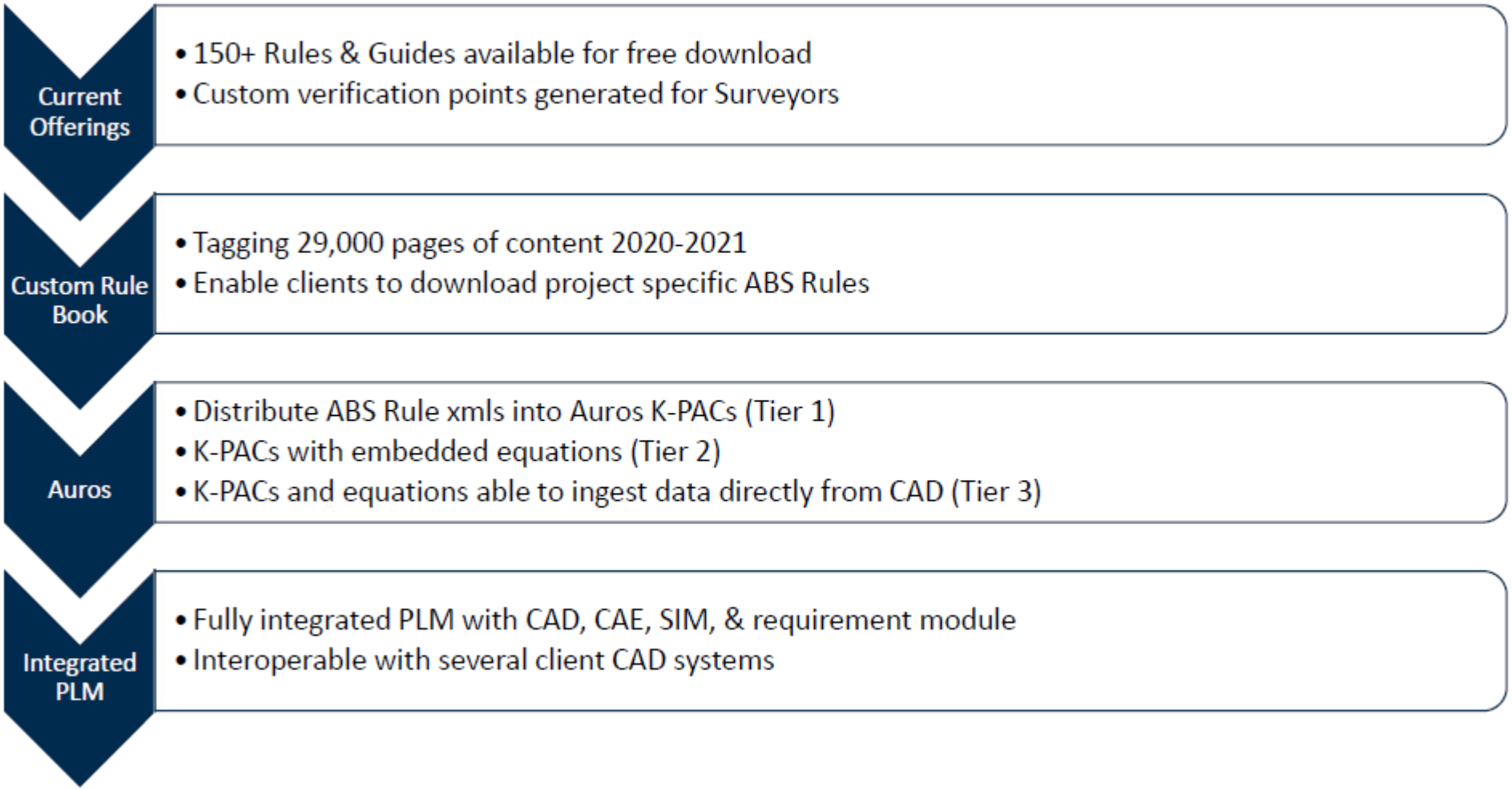


ABS / Auros Operating Model

ABS / Auros Operating Agreement

- Purpose:
  - Provide ABS Rules as Knowledge Packets organized in Assessment Controls
- Operating Model is Under Development but will cover:
  - Software Development and Maintenance
  - Conversion of Rules to Knowledge Packets
  - Generation of Assessment Controls on demand

ABS Digital Vision

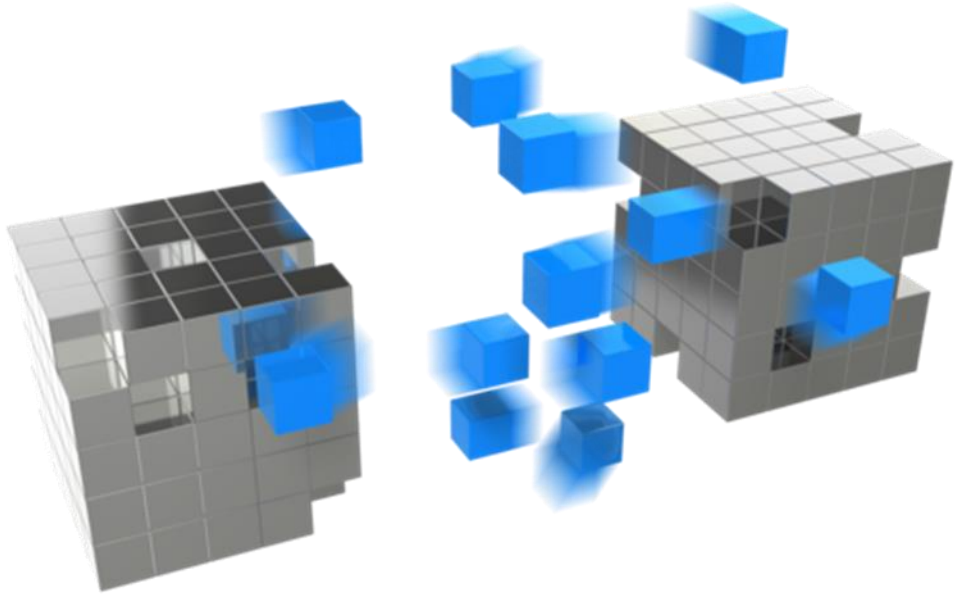


Phased Rollout

- Tier 1
  - Available once Operating Agreement is Finalized
- Tier 2
  - Phased in by Ruleset as:
    - Authoring Best Practices are Applied
    - Continued development of Translator as New Patterns are Identified with each Ruleset
- Tier 3
  - Phased in by Ruleset as:
    - Parameter Naming Convention included in Rulesets
    - Continued development of Translator to incorporate Parameter Naming Convention with each Ruleset
    - Availability of Applicable CAD Connectors
      - ShipCon Connector
      - Other CAD Connectors are already available

Questions and Comments

Questions and Comments



Thank You